Journal of the Royal Society of Arts

NO. 4992 FRIDAY, 7TH DECEMBER, 1956 VOL. CV

FORTHCOMING MEETINGS

MONDAY, 10TH DECEMBER, at 6 p.m. The last of three CANTOR LECTURES, entitled '*Engineering Electronics* (*excluding radar and Service equipment*)', will be delivered by L. E. C. Hughes, A.C.G.I., D.I.C., B.Sc.(Eng.), Ph.D., M.I.E.E.

WEDNESDAY, 12TH DECEMBER, at 2.30 p.m. '*Science in Kitchen Planning*' papers, by Mrs. Mildred Wheatcroft, M.A., Chairman of the Research Committee, Council of Scientific Management in the Home, and Miss Joan E. Walley, B.Sc., Head of Household Science Department, Queen Elizabeth College, London University. John Gloag, Hon.A.R.I.B.A., a Member of Council of the Society, will preside. (The Papers will be illustrated with lantern slides.)

THURSDAY, 13TH DECEMBER, at 6 p.m. '*The Designer's Status in Industry*', by Sir Gordon Russell, C.B.E., M.C., F.S.I.A., Past Master, Faculty of Royal Designers for Industry, and Director, Council of Industrial Design. The Oration will be preceded by the presentation, by the Chairman of the Council, of the R.D.I. Diploma to Mr. Reynolds Stone and the Bicentenary Medal to Dr. W. J. Worboys.

TUESDAY, 1ST JANUARY, at 6.30 p.m. FILM EVENING: *Coral Wonderland*; *South Africa's Game Parks*; *Rythmetic*; *The Staunch Tin Soldier*; *Weather Forecasting by Radar* (all colour films). A full programme will be published in the next issue of the *Journal*.

WEDNESDAY, 2ND JANUARY, at 2.30 p.m. (DR. MANN JUVENILE LECTURE.) '*From Cocoa Bean to Chocolate*', by F. H. Banfield, M.Sc., Ph.D., F.R.I.C., Director British Food Manufacturing Industries Research Association. Tea will be served after the lecture.

MONDAY, 7TH JANUARY, at 2.30 p.m. (DR. MANN JUVENILE LECTURE.) '*The Story*

of Pantomime', by Tom Arnold. (See special notice below concerning admission to these two lectures.) Tea will be served after the lecture.

Fellows are entitled to attend any of the Society's meetings without tickets (except where otherwise stated), and may also bring two guests. When they cannot accompany their guests, Fellows may give them special passes, books of which can be obtained on application to the Secretary.

JUVENILE LECTURES

Special tickets for the Juvenile lectures which are announced above are now available, and will be sent to Fellows on request as far as the accommodation of the hall permits.

Fellows are entitled to apply for tickets admitting one adult and two children to each lecture, and should state the exact requirements within this limit when making application.

JOURNAL INDEX

The index and title page for Volume 104 of the *Journal* are now ready and will be supplied free to Fellows who ask for them. The binding cases for the *Journal*, with which an index and title page are automatically supplied, are at present being re-designed in order to bear a family relationship to the new *Journal* cover, and a further announcement will be made when these are available. Fellows are asked not to send advance orders for the binding cases, which are supplied direct from the Society's book-binders. The index and title page alone may be applied for now.

THE SOCIETY'S CHRISTMAS CARD

The stock of the Society's Christmas Card is now exhausted, and no more orders can, therefore, be accepted.

CHEMISTRY AND THE SUGAR CANE

A paper by

PROFESSOR L. F. WIGGINS, D.Sc., Ph.D., F.R.I.C., Director of Sugar Research, Imperial College of Tropical Agriculture, Trinidad, B.W.I., read to the Commonwealth Section of the Society on Tuesday, 13th November, 1956, with Sir John Simonsen, D.Sc., LL.D., F.R.I.C., F.R.S., a Member of Council of the Society, in the Chair

THE CHAIRMAN: The whole economy of the Caribbean Islands, British Guiana and Mauritius is dependent upon sugar cane. It is therefore not surprising that, when the Colonial Products Research Council was started in 1943, the first research they initiated was on the possibility of utilizing cane sugar, sucrose, as a source of industrial products. Sugar is always produced in a far greater quantity than can be used for purely nutritional purposes, and of course it could be produced at even larger quantities if there was a demand. We were peculiarly well situated, in this country, to initiate research on this particular problem, because we had as a member of our Council the late Sir Norman Howorth, who was the greatest living authority on carbohydrate chemistry. He therefore started research on this problem and our lecturer this evening, Professor Wiggins, was entrusted with the experimental work.

In the same year, 1943, Sir Robert Robinson and I paid a visit to the West Indies and in a meeting with the Sugar Growers Association we suggested to them that it would be a very good idea if they were to start a research association, on the lines of those research associations which had been so successful under the Department of Scientific and Industrial Research in this country, to investigate the possible technical uses of sugar. Now, of course, all these kind of things take a long time to get working. However, in due course a laboratory, designed by Professor Wiggins, was built in the grounds of the Imperial College of Tropical Agriculture in Trinidad. He has there carried out research on this problem. Professor Wiggins has an international reputation on the subject of sugar chemistry. He has received from our parallel organization in the United States one of their prizes and I am sure you will not wish me to keep you any longer from listening to him while he tells us something about chemistry and the sugar cane.

The following paper, which was illustrated with a film, was then read:

THE PAPER

INTRODUCTION

When one thinks of sugar from the West Indies, Queensland or South Africa, one does not immediately link with it the science of chemistry, yet chemistry has long played a part in the building up of what is now a great industry. My object in this lecture is to discuss the present and possible future impact of

chemical science on the cane-sugar industry, rather than to dwell on the past, but it might be as well to mention a few instances of how chemistry has helped to build up the cane-sugar industry to its present status.

CHEMISTRY AND SUGAR-CANE AGRICULTURE

The most striking example of the value of chemistry to the development of sugar-cane agriculture is the advent of synthetic fertilizers. Without synthetic ammonia it is most unlikely that the sugar industry could have approached its present size. When Lawes and Gilbert first showed that inorganic nitrogen could replace that in farmyard manure, the only material available for large-scale use was the saltpetre deposits in Chile. As the use of inorganic fertilizers grew, it became evident that those deposits would be inadequate to provide all the nitrogen required by an expanding agriculture, and it was left to the art of the chemist to develop an alternate source in the form of the Haber Process for the fixation of atmospheric nitrogen, which was discovered just before the First World War. It is well to remember that this process had its origin in the mind of a University Professor working on the thermodynamics of gas reactions from a fundamental view point. No doubt the First World War sped along the development of the process, but within thirty years the synthetic fertilizer industry produced about three million tons per year, whereas saltpetre is only used to the extent of about 50,000 tons per year.

How greatly the cane-sugar industry depends upon this chemical discovery is obvious from the fact that in most cane-growing areas about two to six cwts. of sulphate of ammonia are applied every year to every acre of sugar cane. For a long time it has only been possible to envisage the economical working of the synthetic ammonia process on a very large scale, but in more recent years modern developments have made it possible to consider the building of smaller plants, which might serve large agricultural areas which are remote from the great industrial countries. It is mooted that Hawaii, Venezuela and Puerto Rico are to build ammonia plants to serve their own agricultural industries. Of course, the manufacture of ammonium sulphate requires ready access to gypsum or to sulphuric acid, and few tropical countries can provide either. Venezuela and Trinidad are fortunate in as much as they have oil refineries producing by-product sulphur, and are able to make sulphuric acid. However, modern agricultural research has made a major advance in recent years in the method of application of nitrogen to the land. It has been found both in Puerto Rico and Hawaii that ammonia itself, either in the anhydrous form or as *aqua* ammonia, may be used on certain soil types, just as well as ammonium salts. It is possible, therefore, for tropical countries, without access to gypsum or sulphuric acid, to undertake the manufacture of their own nitrogen fertilizer.

The chemist has also aided the sugar-cane grower enormously with the production of herbicides and insecticides. It is quite certain that, although the plant breeder has played a most important part in the growth of the sugar industry, the use of chemical fertilizers, herbicides and insecticides has contributed in no less a degree to the higher production figures for sugar cane

which have been recorded throughout the world in the post-war years. Large amounts of such materials as gammexane, D.D.T. and 2:4-D are annually consumed by the sugar industry. Indeed, sugar-cane agriculturalists are looking to the chemist to produce new materials to help combat the insect pests which still plague their fields and which the common insecticides do not adequately check. For example, only last year great damage was done in Trinidad by a pest known as frog-hopper, which gammexane or D.D.T. seemed powerless to control adequately. So the need for new and more active materials is very real and the sugar-cane agriculturalist looks to the chemist for help in this problem.

CHEMISTRY AND SUGAR TECHNOLOGY

It is well known that chemistry plays an important part in the manufacture of sugar from the cane. Indeed, in most factories the person who runs the process is labelled 'the factory chemist', although his job is mainly concerned with the application of chemical and physical methods of factory control. The actual process of producing sugar from sugar cane is almost wholly a physical one. This is evident when the main steps in the process are considered:

1. The crushing of the cane to extract the juice.
2. The clarification of the juice to remove colloidal impurities and some inorganic and organic non-sugars.
3. The separation and filtration of the clear juice from the sediment.
4. The evaporation of the clear juice to syrup.
5. The reduction of the syrup to a magma of crystalline sugar and molasses and the separation of the sugar crystals by centrifuging.

Nevertheless, chemical changes are associated with some of the steps and the understanding of these will help in the efficient working of the sugar factory. An example is the interaction of reducing sugars and amino acids, both of which are inevitably present in sugar-cane juice. This reaction is partly responsible for the dark colour of raw sugar and also affects the quality of the molasses left after sugar crystallization. It is very likely, in those cases where molasses stored in large tanks has been found to solidify and sometimes to catch fire, that the trouble may be traced to the reducing sugar-amino acid reaction. Another example which demonstrates where chemistry is of assistance to the efficient working of the sugar factory is the evaporator scale problem. Every sugar factory is plagued by the incrustations which occur on the heating surfaces of the evaporator which inevitably impede heat transfer and slow up the whole process of sugar manufacture. The removal of this scale is sometimes difficult, yet, if the descaling carried out during the week-end shutdown is incomplete then the situation is aggravated. A method of removal of a type of scale consisting essentially of calcium compounds has been developed in Trinidad and involves the use of ethylenediaminetetraacetic acid in slightly alkaline solution. This complexes the calcium salts, which form the backbone of the scale, so converting them into soluble materials which easily wash away from the sides of the evaporator tubes. Moreover, this procedure has no deleterious action

on the metal parts of the evaporator, which do indeed suffer when acid descaling chemicals or mechanical methods are used.

CHEMISTRY AND THE FURTHER DEVELOPMENT OF THE SUGAR-CANE INDUSTRY

My main object is, as I have mentioned above, to indicate what the future impact of chemistry on the sugar-cane industry might be. There is rapidly growing up throughout the world an increased interest in the possibilities of the chemical utilization of sugar and the by-products of the sugar industry. Just as a special branch of science-petrochemistry has grown up around the full utilization of oil, so the sugar industry is evolving its field of 'sucrochemistry'. This word, which is of American origin, has come to include not only, as the name implies, the chemistry of sucrose itself, but also the chemical utilization of the by-products of the industry.

There is certainly a resemblance between the development of petrochemistry and of sucrochemistry. In the petroleum industry the first efforts to convert crude oil into fuels for internal combustion engines gave rise to large amounts of waste products which were not immediately useful. Similarly the natural gases evolved when oil was won in the field were not at first greatly used. Nowadays, there is a whole new industry based on the utilization of these materials. It is noteworthy that the growth of this industry, at least in Great Britain, is of quite recent origin and it is only during the last few years that great progress has been made. On the other hand sucrochemistry is only at the beginning of the road. Nevertheless, it is possible to foresee that similar developments may take place which would be of great help to an agricultural industry in the lesser developed areas of the world.

The sugar industry possesses a number of products which could be envisaged as raw materials instead of waste products, and what is more, produces them in large quantities. The following table shows what these materials are and their approximate annual production:

TABLE I. THE PRODUCTS OF THE CANE-SUGAR INDUSTRY

Sucrose	40 million tons (including beet sugar)
Molasses	1 billion gallons
Bagasse	25 million tons (dry weight)
Filter mud	2 million tons (dry weight)

It is worth noting that these materials are obtained annually from the soil just as interest is produced on capital, they are not made by making inroads into capital which is the case with coal and oil. Agricultural raw materials must compete economically with coal and oil, and it has been said that this will be impossible until such time as stocks of coal and oil are seriously depleted. However, modern developments suggest that this is not so and there is at least

one instance where it has been possible for a 'Sucrochemical' to compete with an oil industry product.

SUGAR AS A CHEMICAL

If we are to use sugar in chemical synthesis, the first question to be asked is, will it compete in price with other raw materials used in chemical industry? At present, raw sugar at the Commonwealth negotiated price is 4.3d. per lb. c.i.f. London Docks and at the world price 2.7d. f.o.b. Cuba or 3.3d. delivered. These prices are not in fact too dissimilar to basic materials commonly used for chemical synthesis. For example, benzene is quoted at 4½d. per lb. and methanol at 3½d. per lb. Such materials as ethylene glycol at 11d. lb. and pentaerythritol at 2s.6d. per lb., which are similar to it in character, are much more expensive than sugar. Thus, sugar is not really out of phase economically with other general chemicals. If we now consider molasses as a source of sugar, we see that a still more favourable position obtains. Molasses contains about sixty per cent of sugars—sucrose, glucose and fructose and, although these cannot be easily recovered in pure state, nevertheless there are many uses for the mixture. At the present time molasses is worth about 5d. a gallon of 13 lb. weight so that the sugars in it may be valued at about ½d. per lb.

Let us consider first what the chemist can do with the sugar molecule.

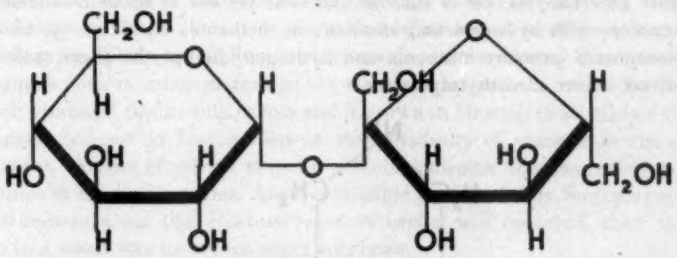

FIGURE 1. *Sucrose*

The essential features of the sugar molecule are that it has eight hydroxyl groups and that it is composed of two different hexose units joined by a glycosidic linkage. The hydroxyl groups are readily esterfied with fatty acid residues. For example sucrose octa-acetate is well known and is actually on the market in the United States as a denaturant for alcohol. Long chain fatty acids—such as palmitic acid, can also be linked to sucrose, but the product is usually a mixture of compounds in which those containing five or six palmitate residues predominate, and it has no strikingly useful properties. Recently, it has been found possible to introduce a single fatty acid group into the sucrose molecule and these products do show considerable promise. Sucrose monostearate is made by alcoholysis using sucrose, methyl stearate, an alkaline catalyst, and a solvent which will dissolve both the sugar and the fatty acid ester. There is obviously a very limited range of solvents which are suitable and, although it is expensive,

dimethyl formamide is the best. Assuming good solvent recovery, it has been calculated that sucrose monostearate could be made for about 21 cents (U.S.) per pound. This substance has the inherent characteristics of a surfactant—it has water-repellent and water-attractive parts. It has been found, however, by the Sugar Research Foundation of the United States, which has been responsible for this work, that the maximum amount of detergency is obtained when the number of carbon atoms of the fatty acid equals the number of carbon atoms in the sugar. Thus lauric acid, when combined with sucrose, gives a product which is a better detergent than sucrose monostearate. This indicates that perhaps the mixture of fatty acids found in coconut oil would give a product with good detergent properties. The sugar detergents are both non-toxic and tasteless, and non-irritant to the skin and membranes of the eyes, so may find application not only in washing machines for dishes and clothes, but also for shampoos, toothpastes, and so on. The fact that monoesters of various types can be made from sucrose opens up a wide field in sugar chemistry, since various organic acid residues may be attached to sucrose and the properties and structure of the products studied. Unsaturated fatty acids, such as oleic or linoleic acids, may be used and it has already been found that the products have excellent drying oil properties. Here again the products are relatively cheap and preliminary tests on their properties and on their costing are encouraging.

A quite different reaction of sucrose that is as yet not at all well understood is its reaction with hydrogen and ammonia in methanol. At about 130°C. and 100 atmospheres pressure ammonia and hydrogen disrupt the sugar molecule and convert it into 2-methylpiperazine.

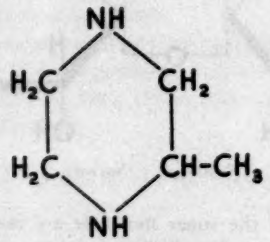

FIGURE 2. *2-methylpiperazine*

This reaction, in our hands, has only worked in poor yield, but if this can be improved, it may be of some importance; 2-methylpiperazine could be used in making Nylon-like synthetic textile fibres. It could quite conceivably replace the hexamethylene diamine used in ordinary nylon synthesis. Another possible use is in the pharmaceutical and veterinary fields, since piperazines are proving valuable agents against certain types of intestinal parasitic infestations.

Since sucrose is clearly composed of two individual sugars, glucose and fructose, it should be possible to convert it into these two components. The merest trace of acid will 'invert' a sucrose solution and so give rise to a mixture of glucose and fructose. Although this is simple, it is extremely difficult to

separate efficiently the glucose and fructose in the crystalline state. Glucose may be crystallized from 'invert' syrups of about eighty degrees brix but under the most favourable conditions it is difficult to recover more than fifty per cent of that theoretically available. The separation of fructose is even more difficult and indeed it cannot be crystallized directly from 'invert' syrup. A method which is effective is to convert the fructose into its insoluble calcium complex by treating it with lime at 0–5°C. Glucose does not form an insoluble complex under these conditions. Based on this fact the following is an outline of the procedure that has been evolved for preparing fructose from sucrose:

1. The inversion of sucrose.
2. The precipitation of calcium fructosate.
3. Washing the fructosate free from glucose.
4. Carbonatation of the calcium fructosate in aqueous suspension.
5. Filtration of the precipitated calcium carbonate and the evaporation of the filtrate.
6. The crystallization and separation by centrifuging of the fructose.

This process is quite old, but the technical difficulties in working it have hitherto made fructose an extremely expensive material. We have now carried out a detailed study of the above-mentioned steps and have been able to iron out the difficulties at each stage, so that we believe it will now be possible to manufacture fructose for about 5s. per lb. This is assuming that the glucose moiety is not recovered. Considerable interest is developing in fructose at this price. There are at least two companies in the United States which are making it; one is using sucrose as the raw material and the other the Ti plant which produces inulin-rich tubors and is grown in Hawaii. It is believed that the increased interest in fructose lies in the possibility of using it in the diet of diabetics, certain of whom may be able to consume fructose safely without recourse to insulin injections. Another possible use is in frozen food preparations. If it does turn out that fructose becomes useful as a foodstuff, then this will help in a small way to use up sugar surpluses.

Hydrogenation of sucrose is a reaction of some importance. Hydrogen at elevated temperatures cleaves sucrose in aqueous solution into two parts, which are then converted into mannitol and sorbitol. The proportions, when the reaction is carried out in mildly alkaline solution, are one-third mannitol and two-thirds sorbitol, mannitol being readily separated by crystallization from water. Thus, we have a straightforward method of manufacture of mannitol and sorbitol from sugar.

When the hydrogenation is carried out under more drastic conditions, the sugar molecule is broken down into small fragments and glycerine, ethylene and propylene glycols are formed. This process was used in Germany during the Second World War as a means of obtaining materials for use in the manufacture of explosives. Very recently, it has been reported that a large chemical company in the United States has developed the hydrogenation of sugar as a method of obtaining pure glycerine and is indeed successfully competing in the production of this material against the petrochemical industry.

Interesting and valuable products are also made from sucrose when it is used as a substrate for micro-organisms. The manufacture of Dextran as a blood plasma substitute is now well established in several countries, some of which are Great Britain, South Africa, Sweden and the United States. A special strain of *Leuconostoc Mesenteroides* produces copious amounts of gum Dextran which, suitably purified, is an excellent blood plasma substitute. It is composed solely of glucose units and is, therefore, practically innocuous. Dextran is not new. Indeed, it has long been known as an undesirable by-product of sugar manufacture which blocks pipe lines in the factory and causes considerable havoc, turning up when stale cases are processed and over-liming of juice is practised. Yet, the controlled production of Dextran gives a material of very great medicinal value. A derivative, Dextran sulphate, is of considerable medical interest in as much as it might be possible to use it as a substitute for Heparin, the blood anticoagulant, which is difficult and very expensive to isolate from natural sources. Another possibility is the production of pure cellulose by the growth of such organisms as *Acetobacter Xylinum* on sucrose.

MOLASSES AS A SOURCE OF CHEMICALS

The use of molasses as the substrate for growing micro-organisms to produce substances of industrial value is very well known. The production of alcohol by fermentation is still, despite serious competition from the petroleum industry, an important industry. Similarly, the production of acetone and butanol by fermentation is still carried out on a large scale. Rum manufacture in such countries as British Guiana and Jamaica forms a major bulwark to the economy of the sugar industry to those places. The production of bakers' yeast from molasses is well known and the manufacture of food yeast for human consumption a possibility. A special strain of Torula yeast was produced by Dr. A. C. Thaysen, but its commercial development has not been very successful in Jamaica, where the first factory was laid down. One difficulty was that it was not possible to make the product palatable enough or cheap enough for it to enter into the diet of the protein-deficient native. Puerto Rico, however, is still persevering with this project and may have an answer to the palatability difficulty by mixing the dried yeast with molasses. Puerto Rico is carrying out large-scale experiments with school children. Indeed, if a pleasant form of the yeast is obtained it may well become a useful protein supplement for undernourished people.

Since the sugars in molasses only cost about a ½d. per pound they form a cheap raw material for chemical processes and there are two reactions which stand out in potential importance. One involves the acidic degradation of the sugars in molasses, and the other alkaline degradation. In the latter the essential reaction is:

$$\underset{\textit{Hexose sugars}}{C_6H_{12}O_6} \longrightarrow \underset{\textit{Lactic acid}}{CH_3 \cdot CHOH \cdot COOH}$$

This occurs on heating molasses with lime at 220°C. under pressure—the reaction is fairly rapid and is complete in about ten minutes. A continuous

reactor has been devised at the Imperial College in Trinidad and it has been demonstrated that the continuous production of lactic acid is a possibility. However, the future of such a scheme depends upon the production of a very cheap lactic acid. For those purposes where glycollic acid, made from petrochemicals and which is now priced at only 9 cents U.S. per lb., is used, it is not possible to compete, but where a three-carbon system is necessary there is a chance for synthetic lactic acid.

The acid degradation of sugars leading to levulinic acid is more promising.

$$C_6H_{12}O_6 \longrightarrow CH_3 - CO - CH_2 - CH_2 - COOH$$

Hexose sugars *Levulinic acid*

A plant has been developed in Trinidad for the semi-continuous production of levulinic acid by the high temperature and pressure reaction of molasses with dilute hydrochloric acid. It is unlikely, however, that levulinic acid can be manufactured at a selling price of less than 5s. per pound. Nevertheless, this material is a versatile organic compound which is amenable to innumerable chemical reactions and it may well become a useful organic intermediate for the fine chemical industry.

Very recently, studies have been made of the reaction of molasses with ammonia. Molasses is well known as a cattle food and its use in this direction has expanded considerably in recent years. It has the defect, however, of being deficient in nitrogen, so that it cannot be classed as a body-building food. It is well known that ruminants are able to synthesize protein from simple nitrogen compounds of either inorganic or organic nature and the idea was conceived that it might be possible to combine the sugars in molasses with ammonia, so that a more valuable cattle food would result. Ammonia does indeed react vigorously with molasses, especially if the sucrose contained in it has been previously 'inverted', and as much as six per cent of nitrogen, bound in an organic form, may be introduced into the molasses. However, the product has toxic properties and cattle fed with it were found to become highly excitable and likely to do mechanical damage to themselves. A chemical examination of the material revealed that the ammoniation reaction resulted in the transformation of reducing sugars to imidazole and pyrazine derivatives and the toxicity was traced to 4 (5)-methylimidazole. The toxic properties could be removed or diminished by either solvent extraction of the ammoniated molasses, whereby the small molecular weight imidazoles and pyrazines are removed, or by acidification.

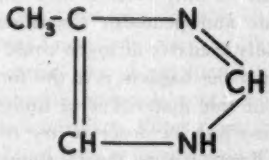

FIGURE 3. *4(5)-methylimidazole*

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A plant has been developed in Trinidad for the semi-continuous production of levulinic acid by the high temperature and pressure reaction of molasses with dilute hydrochloric acid. It is unlikely, however, that levulinic acid can be manufactured at a selling price of less than 5s. per pound. Nevertheless, this material is a versatile organic compound which is amenable to innumerable chemical reactions and it may well become a useful organic intermediate for the fine chemical industry.

Very recently, studies have been made of the reaction of molasses with ammonia. Molasses is well known as a cattle food and its use in this direction has expanded considerably in recent years. It has the defect, however, of being deficient in nitrogen, so that it cannot be classed as a body-building food. It is well known that ruminants are able to synthesize protein from simple nitrogen compounds of either inorganic or organic nature and the idea was conceived that it might be possible to combine the sugars in molasses with ammonia, so that a more valuable cattle food would result. Ammonia does indeed react vigorously with molasses, especially if the sucrose contained in it has been previously 'inverted', and as much as six per cent of nitrogen, bound in an organic form, may be introduced into the molasses. However, the product has toxic properties and cattle fed with it were found to become highly excitable and likely to do mechanical damage to themselves. A chemical examination of the material revealed that the ammoniation reaction resulted in the transformation of reducing sugars to imidazole and pyrazine derivatives and the toxicity was traced to 4 (5)-methylimidazole. The toxic properties could be removed or diminished by either solvent extraction of the ammoniated molasses, whereby the small molecular weight imidazoles and pyrazines are removed, or by acidification.

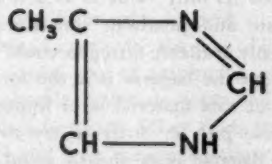

FIGURE 3. *4(5)-methylimidazole*

However, carefully controlled feeding trials revealed that ruminants were not able to make great use of the nitrogen present in ammoniated molasses if this was the sole source of nitrogen foodstuffs, and it is unlikely that its use in cattle feeds will ever become widespread. However, the ammoniation reaction as a means of preparing imidazoles and pyrazines may still be of importance.

BAGASSE UTILIZATION

Bagasse, the fibrous part of the sugar cane, is really the major constituent of the plant. It is produced in large quantities by every sugar factory and, although used universally as factory fuel, the surplus available becomes an embarrassment to many sugar factories. With modern boiler improvements, even larger surpluses are likely to be produced. A large factory in Trinidad produces about 20,000 tons of surplus bagasse per annum. One well-known outlet for bagasse is in making Celotex and Trinidad exports some 15,000 tons annually for this purpose. Many countries are now making paper from bagasse and indeed very good quality paper and cardboard may be made, particularly if the bagasse pulp is mixed with small quantities of wood pulp. In our hands, bagasse has been found easy to pulp and a simple short-time caustic soda cook has been found adequate. The sulphite method also produces good quality paper. Bleaching is achieved by alternate treatment by chlorine and caustic soda. The chief difficulty in exploiting bagasse paper manufacture is the cost of transporting the product from the tropical country in which it has been produced to a more highly developed user country, such as the United States or Great Britain. In a small country it would be impossible to use all the paper that an economically sized factory could produce and, therefore, export of the main bulk of production is essential; nevertheless, even with high freight rates, sugar manufacturers could probably turn out good paper or paper stock from bagasse economically if they were given guaranteed markets and stable prices. I feel sure that, eventually, bagasse will be used more generally in this way, but the time will be hastened if it becomes possible to construct smaller paper- and cardboard-making plants capable of economic working. In an effort to find an outlet for bagasse which would be of local importance, we have tried to convert it into a cattle food. The keeping of livestock is difficult in the tropics, because of the poor nutritive quality of the grasses and because of seasonal droughts which deplete the pastures. Cheap concentrate feeds are badly needed. Bagasse contains only lignin, cellulose and pentosan materials and has little nutritive value, and when consumed by animals its only value is as a roughage. It would be more acceptable if the cellulosic and pentosan constituents could be made more digestible and if nutritionally available nitrogen could be incorporated. Bagasse-molasses mixtures, in which the bagasse is in the form of fine siftings or pith, have long been known, but this material is of limited use. Recently, we have tried to ammoniate bagasse pith in order to try to modify and increase the digestibility of the fibre. Bagasse does absorb about two per cent of nitrogen when treated in the dry state with anhydrous ammonia and forms an attractive

product when mixed with an equal amount of molasses. The product is readily eaten by animals, is non-sticky, and can be easily handled. Moreover, the ammoniation reaction halves the bulk of bagasse and this is still further reduced when the product is mixed with molasses. Experiments carried out in Florida have shown that cattle fed 5½ lbs. of ammoniated bagasse together with citrus meal, cotton seed meal and molasses gained an average of 3.11 lbs. per head per day. From digestibility trials carried out in Trinidad, it has been found that about fifty per cent of the dry matter in ammoniated bagasse-molasses mixture is digestible and about forty per cent of the nitrogenous matter is utilized. These trials were carried out using eight animals and, although the results are averages, the individual figures showed no marked divergencies; therefore, the digestibility co-efficiencies seem to be reliable and indicate that the ammoniated bagasse-molasses mixture may indeed be a useful food ingredient.

The ammoniation is easy to accomplish since anhydrous ammonia and dry bagasse pith react readily together exothermically. It is fortunate also that the reaction seems to affect the physical nature of the bagasse, for the fibres seem to become more rounded and the sharp edges to disappear. Ordinary bagasse pith is not too attractive to cattle because of the sharp fibres contained in it. From experiments on the individual constituents of bagasse, it is fairly clear that the reaction affects mostly the lignin portion of bagasse. A table given below indicates the extent of ammonia fixation when the isolated pentosan, lignin and cellulose components of bagasse are separately ammoniated:

TABLE II. AMMONIATION OF BAGASSE CONSTITUENTS WITH CONCENTRATED AQUEOUS AMMONIA

Ammoniation conditions	*Pentosan*	*Lignin*	*Cellulose*
30° C. (144 hrs.) ...	0·63	2·83	—
100° C. (4·5 hrs.) ...	0·64	3·01	0·13
125° C. (4·5 hrs.) ...	0·74	3·46	—

(Figures in the table are total nitrogen per cent dry matter.)

FILTER CAKE AS A SOURCE OF HARD WAX AND ORGANIC CHEMICALS

Filter press mud or vacuum filter cake, in most sugar factories at the present time, is dumped on to cane land nearby for the sake of its fertilizer value. Although this procedure may be a useful way of employing filter press mud, there are, in my opinion, several valuable materials contained in it which ought to be extracted before using it as a fertilizer. Filter press mud does contain considerable quantities of hard wax and fatty materials—sometimes up to thirty per cent of its dry weight. Simple extraction of dry filter mud with petroleum solvents

removes both of these constituents, and methods have been evolved both in the British West Indies and elsewhere for the separation of the two. Good quality hard wax has been obtained on a large pilot plant scale in Barbados and various grades of wax have been made suitable for use either in the carbon paper industry or for making emulsion floor polishes. Disappointingly little success has attended efforts to sell these materials and the project has had to be, at least temporarily, abandoned in the British West Indies. In Cuba and the United States it is estimated that nearly 1,000 tons are made and used annually.

The fatty materials which accompany the hard wax are also interesting. Hydrolysis of the crude material leads to the isolation of two sterols, sitosterol and stigmasterol, both of which are important in the pharmaceutical industry. I believe that a large pharmaceutical company in the United States buys large quantities of sugar cane fatty material, which is a by-product of cane wax manufacture in Cuba, for its sterol content. Analysis of sugar cane fatty material from Trinidad showed a sterol content of four per cent. The fatty material also contains considerable quantities of a long chain fatty alcohol known as ceryl alcohol, which is essentially a C_{26} alcohol. This has been obtained from cane wax itself in about thirty per cent yield and from the fatty by-product of cane wax manufacture in about ten to 15 per cent yield. Fatty acids, both of the saturated and unsaturated type, are also present in the fatty material and may be isolated by ordinary methods. It is, therefore, clear that the lipid constituents of the sugar cane give rise to several industrially valuable materials.

THE CHAIRMAN: We have had this evening, painted with a very broad brush on a large piece of canvas, examples of the part which chemistry is playing in the development of the sugar industry in all its many varied aspects. We sometimes forget, I think, with reference to cane sugar, that there are many products of the sugar cane other than sugar; as we have seen, there are the molasses and the wax. Professor Wiggins has described, in a very admirable manner, that attempts are being made to utilize these and all the other substances. Undoubtedly, if the by-products of the sugar industry could be utilized it would perhaps be advantageous to us in this country. Cane sugar itself might become cheaper, because of the profit made on the by-products. There are many difficulties; as you have seen the research is at its very beginning, and is carried out on a comparatively small scale considering the numbers of chemists employed. In the same year, 1943, as we started this research scheme the Americans set up their sugar research association. Of course, they employed about ten times the manpower that we can employ, but I do not think, and perhaps Professor Wiggins will agree with me, that they have really made the original progress in the utilization of the by-products of the industry that Professor Wiggins and his staff in the West Indies and the Birmingham School in this country, have made. I am sure you would like me, on your behalf, to thank Professor Wiggins for the very admirable picture he has given of this industry and the interesting film he has shown us.

A vote of thanks to the Lecturer was carried with acclamation, and the meeting then ended.

THE COMMISSIONING OF WORKS OF ART

A paper by

LOUIS OSMAN, B.A.(Arch.), F.R.I.B.A.,

read to the Society on Wednesday, 14th November, 1956, with A. R. N. Roberts, a former Member of Council of the Society, in the Chair

THE CHAIRMAN: I fully share your regret, and I am sure our lecturer's, that Mr. Mercer, who as Editor of *The Studio* has encouraged innumerable artists and commissioned many, is unfortunately through illness not able to preside this afternoon.

In expressing regret I do not want to suggest for a moment that I do not act as Mr. Osman's chairman with a very great deal of pleasure. When I was Honorary Secretary to the War Memorials Advisory Council which this Society set up in the closing years of the War, Mr. Osman was one of our most helpful supporters, and since then I have watched the progress of his professional career with interest and admiration. When I tell you that he succeeded on a famous occasion in persuading the Mother Superior of a Convent to commission a Jewish sculptor to embellish an addition to her buildings, as a result of which great delight has been given to all the subsequent visitors to Cavendish Square, you will know that he is as well justified on talking about the commissioning of works of art as he would be to speak on their execution.

I am quite sure that his theme this afternoon is a socially important one. When I next speak from this platform I am going to give a talk on that great man W. R. Lethaby. He was aphorist as well as an artist, and he once said 'The task of civilization is to add to what may be loved'. Now the wish to add should be shared by all the 999 of us out of every 1,000 who are not artists. I hope that our lecturer will tell us how to give the thousandth man, the artist, his chance to add to our slender stocks of lasting beauty. If you only tell us how to get out of the artist's way, Mr. Osman, that in itself would be a public service.

The following paper was then read:

THE PAPER

Never before in known history has there been so much Art as there is to-day—art with a capital 'A'. Interest in art will drive a queue a mile long down the Embankment from the Tate Gallery—art sponsored, art education, art thought, art talk, art writing, art on the B.B.C. and television and yet, let's face it, the one thing that is missing in all this, with very rare exceptions, is the obviously great work of art known as such to-day and clearly destined to be known as such to future generations. Never before has there been an age when real genius has been stultified and prevented from giving of its best by the conscious attempt of authority to support and glorify the mediocre. This is not from any lack of genius (as is often thought). It is due to the almost universal failure on the

client's, or commissioning, side to allow the artist of genius to develop and to function properly.

When one speaks of 'the client' nowadays one does not just criticise and castigate the one insensitive individual, but rather a group or committee of individuals who indulge in collective non-responsibility and who do not bother to understand the artist's temperament in the same way as they bother to understand international machinations, the Stock Exchange market, the fat stock prices, or cricket—or whatever else is thought to be of importance.

The fact is that art has ceased to be important and an essential part of life, and has become an illusive and amusing hobby with a titillating element of financial chance—like stamps or the football pools—or premium bonds.

This can be seen in the wide variation which exists between art values as recorded at sales of Old Masters, say at Christie's, and payments made to the finest artists for modern work. Payment to-day for new work is, in fact, only a half to one-third of comparable payment for similar work in the eighteenth century—this, of course, allowing for the variation in the value of money. For example, in 1779 the Governors of Guy's Hospital paid the sculptor John Bacon £1,000 for his marble monument to Guy—a superb work which still survives—a figure of between £15,000 and £20,000 today. One cannot just blame crippling taxation.

Plenty of lip service is paid to art and the commissioning of art, and an incredible amount of money is expended. It is the purpose of this paper to try and diagnose some of those principles which are, in my opinion, a kind of common denominator inherent in all great works of art.

A definition would seem to be demanded—but rather I would say that to have heard Kathleen Ferrier sing *Orfeo* or Toscanini conduct, or to have walked from a crowded street into the National Gallery or into the Victoria and Albert Museum is to know, clearly and without a doubt, what is a work of art—with its intensity of mood and feeling, its unity of design, of proportion, of colour and, above all, the integrity of the work—'to be simply honest' as Van Gogh said.

Few private, cultivated and intelligent people are now in a position to commission works which take any measure of the artist's or craftsman's time to produce but, with well-directed propaganda over the last years some sense of obligation has been installed into authorities and those individuals and committees who, by reason of their position in Government, industry or business life have the control of substantial sums of money. So often, however, the sense of duty has been bounded by the piece of presentation plate, the portrait of the chairman, or the unrelated addition of a bit of art to a completed building project. And so often the result has been disappointing in the extreme, sometimes just disappointing and very occasionally incredibly successful. I am sure that the Fishmongers surprised themselves with Annigoni, but what do the Drapers think of their ceiling or the Board of Trade of the monstrous and constipated colossi that writhe at its portals?

The answer is, of course, that someone must care, and be ready to give thought and time and understanding, and realize that there is an art in commissioning.

The second job I ever had was from that great scholar and business man Sir Dougal Malcolm. His 'brief' to me was 'My boy, I want you to keep Evleyn amused with as little financial embarrassment as possible'. Now he was a member of the Society of Dilettanti, a Fellow of All Souls, and he helped finance archæological expeditions, but he was not prepared to accept the anguish—mental and financial—which is so intimately bound up in the production of any great work of art.

The objects now in the British Museum, which were dug on a particular expedition to the middle of Syria which he helped to finance, are the ordinary pots and pans, beautifully formed and decorated, the cuneiform tablets, beautifully written, the cylinder seals engraved with incredible precision and decorative verve on the hardest of stones, and the cult objects of a particular settlement of a period between 3,000 and 2,000 B.C. I am sure there was no talk of Art—yet it is these and similar objects from the Near and Far East, from Africa and from South America and prehistoric Greece that have been taken over the last thirty or so years as the model to which the modern artist should revert—anathema, of course, is a reversion to the classical modes of China, Greece or Italy. It is 'too contemporary, my dear', to learn from the cult objects of Peru but 'too, too reactionary' if the model be a bronze of Donatello.

And to-day too much talk about art has led to too much confusion. Much has been made of getting back to nature, and material governing the form so that a carving should be like a stone eroded by wind and water: and yet one of the chief exponents of this kind of theory produced little sketches cast in bronze for the stone carving for the Time and Life building—to-day there is a cult of the *Maquette*, and the American market is a great buyer of such objects.

Throughout history objects of art have been an integral part of the daily life and civilization of its owner as the aeroplane is of the service chief, or the motor car of the company director—they must be well designed and efficient and modern, they must incorporate all the lessons of the past but must not be enveloped in a frowsty nostalgia. In the past it was always fashionable to live in a contemporary house surrounded by contemporary objects, though there has always existed an antiquarian interest in the past, and 'museums' have been found in Chaldea and Egypt dating from remote times. The cult of living in a 'Ye olde' house is quite recent and there are fortunately signs of this curious phase passing.

By the first half of the seventeenth century in England, and from then until the early years of the nineteenth century, there grew up a cultured, leisured and moneyed class who loved beauty around themselves and in every part of their life, and were willing to spend the time, thought, study and money necessary to ensure it by perfecting their own job as commissioners of works of art. They were willing to travel abroad to study the finest ancient and modern works that Italy and France could show, and to sharpen their critical abilities so that they could distinguish good from poor in work, and genius from charletan; and they had money to back their judgment—and it is to them even more than the artists that we owe the great heritage of eighteenth-century art. As well as

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having Inigo Jones arrange his collection of Greek and Roman coins and medals, Charles I was commissioning an 'ultra-modern' House of Delight at Greenwich for his Queen, and was commissioning ceiling paintings from Rubens and easel pictures for it from Gentileschi and Jordaens. In fact, most of the works of art which have come down to us from the past are the results of commissions, apart from those sketches and studies which the artists made for their own use in the production of finished works. Even the great set of paintings which survive at Petworth were commissioned from Turner by Lord Egremont—it was this commissioning by clients of discrimination which imposed a discipline and direction in the work which is entirely to the good. The architecture of the eighteenth century, with its panelled walls, formed the ideal background for the easel picture, and such paintings have retained a dominating place in art ever since, however unrelated they are to-day to current forms in architecture and decoration. But it was not until the middle years of the nineteenth century that the romantic idea of unrecognized genius starving in a garret took a hold on the popular imagination—a spate of Thomas Chatterton's—and that artists began to produce the greater part of their output uncommissioned, in the hope of selling their works themselves or through the agency of the Royal Academy or through the art dealers who had sprung up. The rank bad taste of the new rich, and the arrogance of money during the mid-nineteenth century, dealt a blow to the intelligent commissioning of art from which it has never properly recovered. The dealers begot salesmanship and influenced what was produced—as Dior dictates a waist line—and those who did not fit with current fashion did not feed well, and possibly did not feed at all. And so sprang up the successful popular artist of the moment—like Alma-Tadema or Solomon J. Solomon, while the unsuccessful ignored man of principles was, without a commission to his name—like Van Gogh. And so, too, arose that wonderful situation for the art speculator who could wait for these foolish fellows to die before cashing in.

The art history of the early twentieth century has been one of struggle by a number of pioneers to extract art from the muddle into which it had devolved—but the indiscipline has remained and to it has been added the complication of publicity, blatant, vulgar and essential: the artist did not stand a chance unless he was eccentric and as physically 'smashing' as Marilyn Monroe. Some artists tried to get back to first principles, and those who could draw like Raphael at the age of six tried to draw like children at the age of twenty.

The reaction against the stranglehold that the client and the dealer were imposing on the artist's vision was that the artist of worth despised the client and could only express himself by isolation from him—he innoculated himself against the insensitive client. He produced what he wished and someone might buy and, since artists are not on the whole unvocal—no one could call the President of the Royal Academy a silent man—publicized the stupidity and degeneration of the 'pot boiler' and flaunted the integrity of the objects he was producing in the isolation of his studio in Montparnasse, Chelsea or Hampstead; and all this gradually built up to a wildfire success. As *The Times* correspondent wrote some weeks ago:

> To-day the very nature both of fame and of the promise of fame have been deformed by the evil of publicity. No artist dependent for a living on the practice of his art can afford to disregard the efficacy of this monstrous weapon, and since, economically, it is indispensable its use has grown respectable, and those who wield it most adroitly may be openly applauded. . . . The growing power and prestige of self-advertisement is liable to produce a situation in which the most renowned artists are not those who are the most gifted, but those whose gifts are most effectively publicized, and it might be said that the fame of actors and actresses already aspires to this condition.

And so, again from *The Times* we find:

> The 21 year-old singer has got his wish and is to have a part in the film *Love Me Tender*. Since becoming a success he has induced his father, who is only 39, to retire, and he has refurnished a home for his parents and designed some of the furniture himself. He now owns a publishing company, two Cadillacs (one canary yellow, the other pink) a station wagon, and a motor cycle.

And with the publicising of art and because of social consciousness, authority decided it had a moral responsibility to help and feather-bed the artist—like Road Safety—as long as they could find the easy road 'with as little financial embarrassment as possible'. Clearly the holes in the creative artist's time should be filled by arranging that he should teach—*that* is education—and so we have between 1954 and 1955—I have the figures from the Ministry of Education,—10,958 full-time art students under their 'tape'—that is not counting the universities or part-time art students, or music or poetry or ballet—and 1,260 full-time and part-time teachers—a frightening prospect. And what is happening: sometimes these institutions of learning have to carry out work of their own—but the artist is very rarely allowed to apply those standards in his work which his teaching taught him to consider essential. The universities have schools of architecture, decoration, fine art and history of art, and yet they often house their students in hostels from which any artistic expression is eliminated—often the work is done by commercial firms whose standards are utterly opposed to those which the schools are themselves teaching. Many artists of fame and promise, who should be creating, are either teaching a majority of students who will become teachers to teach more students to become teachers or, if they are not so serious, are using a sinecure to provide background security and to establish contacts and distinction and a ready call on a source of lightly-paid staff to carry out the works to which they will attach their name while they are at Royal Institute, club or charity ball, or giving talks on Children's Television or taking part in a panel game. 'I don't bother much about commissions', said a silversmith to me the other day. 'I've got a well-paid job teaching—and the director bothers even less because his job is even better paid'.

I speak, of course, only as this affects 'true art' and works of art; no doubt, out of some 20,000 or so students half a dozen will make the grade—I fully realize that industry will absorb a great number and that the standard of machine-made objects which will find their way into the homes of the majority of the people will be vastly improved. The market is frankly saturated and it is this

superfluity of hangers-on to art that is doing such harm to any serious artists who can survive the self-consciousness induced by the critics. Roots and standards have gone. And 'Joe Smith', in his third year at the Royal College stands a fair chance of picking up a job that should be in the hands of Picasso.

But, despite all this, I have no doubt whatever that eventually the great reach the top. Yet what a lot of opportunities, throughout their development, are missed through those works which could inspire them to heights of imaginative creation not being commissioned. It was not until Epstein was over seventy that any architect asked him to create a modelled work as an integral part of an architectural conception: it was not until a few months ago that Frank Lloyd Wright, that great American architect, was given his first commission in New York. The Tate Gallery purchase works of Rodin and Degos and Matisse from public funds for vast sums, but where are the works of art by these artists commissioned during their lifetime by public authority? Where are the stained glass windows by Rouault or Matthew Smith—that great and unique English colourist—integrating with new architectural conceptions of mass and material for the atomic age?

The mediæval church used the great artists of its day to work together to enshrine in terms of art its spiritual message; the new learning of the Renaissance joined the poetry of Milton to the music of Lawes and to the designs of Inigo Jones—and all commissioned. And at the threshold of the new atomic age, what is the Atomic Energy Commission doing? Is its headquarters in London to integrate science with art with perfect structural form? Have they approached any great artist to see whether this wonderful new exploration of natural science stirs his imagination to creation, as science stirred that of Leonardo da Vinci, or have they asked Dr. Vaughan Williams whether he was inspired to write 'music for a Calder Hall fireworks'—or even a serious work?

Christopher Wren was asked to design the Royal Observatory for Charles II and could design St. Paul's all by himself, doing most of the drawings with his own hands—yet it needs a group of Ministry of Works architects to design 'A Tea Pavilion and Pool' in Regent's Park.

Art, has been so much a part of life throughout history that there has been an art expression of every phase of civilization; the Lascaux caves, the glory of Greece, the grandeur of Rome, the mysticism and aspiration of the mediæval church, the revival of learning, each was parallelled in things seen and heard, but the 12-page supplement on Calder Hall does not mention the words æsthetic, or artist or landscape. Nothing has been sought from the artist, no great music has been caused to be expressed.

But does not the fellow realize that our credit is squeezed and there is no money? It is not money but spirit that creates works of art—the spirit that impelled artists and workmen to weave ropes by hand and cut timber poles, and hew stones and haul them 404 feet high into the air to create Salisbury Spire, or to drag the lintels of Stonehenge across forest and bog in a roadless country—little tough men in rabbit skins—yet, when a single smallish block of South African granite is wanted for the base of the Smuts memorial, it is

given up after two attempts and is built up of small bits instead, imitating a single block.

But there is no money—only money to be spent on public enquiries, motor cars and abominable lamp-posts, on heating and lighting, lifts and attendants for buildings in which to enshrine the glorious works of the past, and in which to entomb those of the present not required as part of our lives—only money

[*Photograph by Raymond Wilson*

Head of Epstein's Madonna from his lead group in Cavendish Square

to train 20,000 art students and find—Lord Citrine's figures—'an additional capital investment at the rate of £20 to £30 millions a year' for atomic energy. The cost of Calder Hall has been £16,500,000, but perhaps later they will find funds and agree public expenditure to commission a silver trowel for the next foundation stone. The promise of Calder Hall—the tragedy of the Festival Hall, that coelacanth ('a fish whose interest is mainly scientific') washed up on the banks of the Thames. It should have been the most inspiring commission for the last hundred years.

There is, I believe, a new Embassy projected in Rome. Can anyone imagine that the Government will allow this to be conceived as a great modern work of architecture, in which the inspiration of one mind will inspire and co-ordinate the enthusiasm of scientists, painters, sculptors and craftsmen; can anyone imagine that silver, or even stainless steel, plate will be commissioned so that in future generations it will stand comparison with the work of Paul de Lamerie—and yet there are those who could do this—or that the door handles touched by everyone entering the building will hold the concentrated feeling of Ghiberti's at Florence or of those little masterpieces of Epstein's on the two doors under the bridge on the north side of Cavendish Square? Yet, would not money so expended be a permanent demonstration of the British way, which the British Council, at considerable expense, is endeavouring to publicize abroad, and be more permanent in its effects than the attempts which the Arts Council are making to insure that the artists of their choice are given an international ovation? No, we are in an age of self-conscious mantlepiece art.

What is wanted is that those with creative ability should be able to devote their energies to creative work on a proper basis of commissioning, without interference or diversion, in direct contact with their clients and certainly not as part of a highly organized business concern for the production of art—sculpture, architecture or other forms. Great works of art are produced at moments of individual artistic inspiration—and all artists know how wayward and illusive the Muse can be—recent studies have even gone as far as to relate the mental phenomenon of inspiration with a state of schizophrenia and have attempted to draw parallels between the work of certain modern artists and that of the mentally deficient—in which has been found at times great æsthetic beauty.

But what is quite certain is that there are moments of vision, and that these can in some measure be induced—not, as has been tried by the opium eaters, by drugs, or by drink, more apt to be a consolation for lack of, than a means of inducing, inspiration, but by the challenge and provocation of a properly commissioned work—challenge of idea, of material and of technique. It is equally true, and any artist will confirm this, that almost invariably commissioners of works succeed in putting the artists' backs up at the most critical moment, either through indifference or interference. My experience has been that every creative artist has, at various stages of his career, certain absorbing interests in thought, material, technique and scale. It is the co-ordination of this with the appropriate commission at the right moment that is likely to produce a situation when a great work of art can be born.

How often, when this state has been induced and the artist has had his moment of vision, has a committee recorded its vote that no action should be taken for six months, or that the work is to be brick not stone, or that the trousers shall or shall not have a turn-up or have started to haggle about money. Equally lacking in understanding is the demand that drawings, sketches and models shall be submitted which are very often not understood, give a completely misleading picture and fritter away the artist's inspiration.

The easy way out, so beloved of modern bureaucrats, is thought to be the competition—but no work ever won a competition which would not have been better done had its author been commissioned direct. Can anyone imagine Beethoven writing his ninth symphony in order to enter it for a competition? Yet many of the greatest works of music—Bach and Mozart spring to mind—were commissioned. There has also now sprung up the semi-dishonest competition—like that recently held by the T.U.C. for sculpture—where a large number of competitors' time and money are wasted by a committee which decides that none of the designs are worthy but, having had their minds focussed on what they do really want and having benefitted by the lesson for which they do not pay, then go elsewhere and commission the work, as they should have done in the first place.

There are those with the ability and the knowledge to distinguish and who, were there a more urgent and more worth-while requirement, would doubtless be ready to give their services and win fame as skilled 'Commissioners of Works of Art'. The Arts Council has been set up, but has little power to commission and certainly none properly to coordinate commissions. The Royal Fine Arts Commission's very name is a contradiction, since it cannot commission or even help commission anything—but is a public buffer and a critical utility.

In the inception of great works a little—very little—early help and encouragement is what is required. I have proved that support will follow. The right principle has surely been established in the case of historic buildings. 'The Historic Buildings Council' has been set up to advise the Minister of Works as to what, from the many claims on the very limited funds which Parliament has voted, he should support. But already the contributions which he has made to the total costs have meant that work which would not otherwise have been done, and which is of the highest importance to the nation, has been put in hand by the encouraged owners. The Pilgrim Trust has given the same wonderful lead—and remains on a sound financial basis.

There is no similar body to which anyone with a great artistic project can apply. The public has not normally got any idea of the insuperable difficulties of an artist's carrying through anything like a large-scale project; the time it takes, the complete absorption and the cost of materials and workmen's time in casting and so on. When it has to link with other arts it is just not done as a speculation. Even when an individual work is carried out on a large scale its fate is usually to find its way into a museum or gallery, instead of taking its right and proper place and part in the life and civilization of the nation.

DISCUSSION

THE CHAIRMAN: Mr. Osman has commented that there was no music associated with a display of fireworks at Calder Hall, but he, I am thankful to say, has given quite a display of fireworks from the platform. He has presented a serious subject in a very lively way, and he will be greatly disappointed, as I shall be, if some of his best points are not controverted from the floor, so I do hope that whether you agree or disagree, you will express your views freely during the discussion.

MR. MARK BATTEN (President, Royal Society of British Sculptors): I am speaking for the Royal Society of British Sculptors. The view stated by the lecturer strikes me as a very gloomy one. We, of course, know that, it is unfortunately very largely true. Our Society has had fifty years of practical experience of putting clients in touch with sculptors.

We have had a trickle of enquiries coming to the Society during that period, and the Society has had the problem of dealing with them. In the early days they were dealt with by the President on a personal basis. Of course, that produced unsatisfactory features and it went on for rather too long. Nevertheless, it was not entirely without satisfactory features, because we know individuals operate in some ways rather better than committees; on the other hand, occasionally you get the other rather unsavoury sides which are bound to be connected with the fact that some individual has the power to give a commission. The Society therefore decided that it would have to do something much more organized about it. Thus since the war it has founded an advisory panel which deals with all enquiries that come in, and the Society has, over that long period, given a free advice service to clients to tell them if they have enough money for the sculpture they contemplate, or, if they have not, what size of sculpture they are likely to be able to afford, and what sort of sculpture they need, according to whether it is to be indoors or outdoors, and so on.

When the clients have got to that stage and have had that advice, they may then approach the Society and say they want a sculptor. The advisory panel then selects preferably an individual sculptor, as our lecturer was advocating. Our Society has always tried to pick a good individual for the job and to see that he gets it. My Society has had the same sort of experience as the lecturer about competitions, competitions being always very unsatisfactory and open competitions being the most unsatisfactory of them all from the points of view of both the artist and the client. As regards the artist, perhaps sixty or eighty good men put in a lot of hard work in an open competition to gain, in effect, nothing more than a lottery ticket! It is all chance and is very discouraging for them; they work hard and they do not get any reward for it at all. That is, from the artists' point of view, the unsatisfactory side of it. They cannot feel like doing their best work if their great effort will only lead to a chance. The artist must be commissioned if possible.

It is also equally unsatisfactory from the client's point of view because the good artist, who is getting commissions, will obviously not go in for an open competition, for the reasons stated.

The other thing is that an open competition nearly always takes the form of a roomful of models, probably limited to 18 inches high, which may be for a twenty-ton figure. Then the assessors go round this confusing roomful of 18-inch high models and they are astounded, very often, to discover afterwards that they are inviting an elderly lady living in Bournemouth, probably in a villa and not in a studio at all, to execute a 19-foot group or something like that. That is the danger. She may make beautiful little models but be completely inexperienced and quite incapable of carrying out the work required.

From the practical side there are a great many objections, so our Society thought it must get over these problems and discourage open competitions. The best people

to make the selection are a committee of artists who know what it is all about. But how could sculptors give the jobs to sculptors? There are the obvious objections. What we devised was something fairly simple. We recruited the advisory panel, once the scheme had started, from people who had received commissions from the advisory panel. They are likely to be the people who do vital work. Such members are more likely to be awarded the jobs, so that when a sculptor receives a commission through the advisory panel, the member of the panel who had been on it the longest withdraws from it and he becomes the new member. The advisory panel is recruited from people in the Society, but makes awards to outsiders as well. So the people who have had jobs become those to give jobs. Whilst a member is on the panel he cannot receive a commission, thus he is automatically barred for a period and the commissions are distributed among those known to be good, the vital people giving the work to the right people in this way.

THE LECTURER: The only point I would like to make is one on competitions. I have never entered an architectural competition. I disagree with them most strongly on principle. But they do have one good purpose. The client has to make up his mind exactly what he wants before commissioning the work. This he very often does not bother to do when commissioning direct. He really has to set some kind of programme and he has to put down on paper what he wants. Certainly it is quite common to find that when the architect is called in, the client has not decided whether he wants six rooms or five. I think if people, when commissioning works, would really think what they want before they start, and wait until they have the money, and everything was ready and then give clear and full directions to the artist, he would work at the subject in a full frenzy instead of having half a job given to him, followed by a series of halts until his inspiration is riddled away. I am not sure at all that I agree with this system of an institute forming a panel to which people can apply and which will do someone's thinking for him.

In my opinion there are usually one, or possibly two, suitable artists for any particular commission. How frequently the wrong person is given the right job! If the Mint wants a new coin produced, I think there are probably two or three people who can do it. It is quite probable that those two or three people would not be asked or would refuse if approached, because what the Mint would demand is that a greatly magnified model should be designed, which is to be mechanically reduced to something which will be carried in the pocket. It is certain to be an artistic monstrosity when it is finished. The two or three artists who probably are competent to produce a coin comparable with the beauty of those of ancient Greece would probably say 'No, I can only model the design to the size of the actual finished coin, it is the only way I can produce a work of art from the commission'.

It is equally monstruous to produce a little model which is subsequently to be blown up to the requisite size. An entirely new work must be created with its own scale and intensity of feeling—art is not pneumatic.

MR. GRAHAM HUGHES: I am from Goldsmiths Hall. I have enjoyed this lecture enormously. I really do not know whether Mr. Osman's statement that art is no longer important to the community is true or not. I should very much like to hear what other people think about that. One sees on the one hand exceptionally well-attended exhibitions and a few very good artists and architects who are overworked and very busy. On the other hand, one sees many good young artists and young architects who have no work at all, and one goes to exhibitions of work by good practising artists which are empty. One also sees the country being rapidly wrecked by frightful æsthetic thoughtlessness.

On this question of too many art students, we have heard that there were 10,900 art students in training between 1954 and 1955. This is an appalling number, and my

own experience at Goldsmiths Hall, where we see a lot of silver designers, is that there are too many bad ones around, all of them claiming to be silver designers, all of them having been through an art school for three, four or sometimes six years, and most of them with no creative instinct in them at all. Whether they are children of parents who thought they were geniuses, or are people who are very good at passing interviews I do not know, but there do seem to be too many bad art students in training at the moment.

A lot of us have a sort of sentimental well-wishing towards art students as a class; as a result they get a very good slice of that part of the nation's wealth which is available for artistic purposes. I wonder if, as a country, we treat our art students too kindly and whether, as a country, we should not try finding a little more money for the practising free-lance artist rather than for the teachers and students, and in this way try to bring more good works of art into being. I think that this country probably attaches more importance to art schools, and gives more money to art students, than any other country in the world at the present time. But I am afraid we cannot claim that our national art shows corresponding merit. I think, perhaps, if we spent more money on art and less on art schools and students, we might become a more civilized nation.

THE LECTURER: I certainly expressed myself badly if I gave the impression that I consider art to be no longer of importance to the community. I consider its importance to the community unrelated to period, but that those periods of the greatest achievement have been those of greatest artistic expression. Art is of the greatest importance to civilization. What I did mean is that contemporary artistic creation has largely ceased to be given its rightful importance by our community in general and by those who should be the informed, creative, enthusiastic commissioners in particular. We have great artists but we hardly use them at all.

MR. A. C. CHAPPELOW: The students should take a course that interests them in the beginning. You do not make an artist in two or three years' training. He has to grow and if the artist has got something really fine in him, it comes out. I think that was where the old patron came in, rather than commercial or government committees. The patron, of course, was the man of discernment and taste. I think the sooner we get back to private people encouraging art, if they can afford to do it, the better. But you certainly do not make an artist in the art schools. His art has to grow to be inside the man.

THE CHAIRMAN: I take it that your point is that we could not really pick our selected few who are going to become real artists. We must train in the rudiments of art more people than can ever conceivably become artists of quality.

MR. CHAPPELOW: You have certainly got to have an elementary training. A child has to learn to walk, but I do not know how artists get along in the early training stage. Then I think it becomes a matter for the soul and of the development of the individual, plus, of course, encouragement from people who have discernment and knowledge.

MR. DAVID WYNNE: I am a sculptor and I have never been to any art school at all, on principle. I do not really believe in them, but have very little experience of them. I do think, though, that in the early stages of a student's life he ought to be taught to work hard. In the old days most sculptors, when they were young, were apprentice masons under a master mason, who was much more interested in getting work done properly than in helping his prodigy along. A boy stayed until he had cut his arris correctly, even if he went without his supper. This was more or less my experience. One could, of course, quote people like Eric Gill who was a letter-cutter by trade.

When I go to art students' exhibitions, which I do very rarely, the thing that strikes me is that they have taken so very little trouble, presumably because other people are running round to take the trouble for them. I am not trying to get at art schools, but this is one of the dangers to a young aspiring man with plenty of talent but perhaps a healthy dislike of hard work.

PROFESSOR MARK R. SPONENBURGH (College of Architecture, University of Oregan, United States): I can well understand the very deep concern that many people here to-day have expressed over this veritable legion of students who are aspiring to the fine arts. I think, perhaps, it is in order that I remind you of a similar problem in the United States of America. Despite the fact that comparatively little art is actually commissioned, art education has become a kind of heavy industry. We have well over 350 colleges for architecture and the allied arts. This is a staggering figure when you consider that each college is overstepping the open market some thirty graduates each year. I am certainly not qualified to suggest how this problem might be honourably solved, but it does seem to me that this matter of patronage and encouragement can be seriously examined from various quarters. I, for one, have been on commissions of sorts; I have also been commissioned and my feeling is that much can be done to create a climate which will generate and maintain enthusiasm. This must originate in the committee. Some sort of mutual compliment must be realized at the very outset of an idea, otherwise the ideal may be swamped by lesser realities.

I think we all recognize, perhaps in varying degrees, that those who are fostering and generating and promoting and projecting the fine arts to-day are those primarily connected with museums and galleries. Again, I will limit my comments to the United States. It strikes me, however, that a most unfortunate situation exists in that the taste makers of to-day are not socially dedicated as were the taste makers of yesteryear. In the final analysis it is the architect who is perhaps best qualified to reunite the visual arts with society. By the same token we must also insist that the architect, throughout the course of his education, be thoroughly prepared as a creative agent, a man of sensitivity, and one who will assume the responsibility of dedicated leadership. Our eminent American architect, Frank Lloyd Wright, was mentioned by the speaker. I beg to remind Mr. Osman that, in spite of the fact that Mr. Wright occupies a very important position in American architecture, he has yet to commission a sculptor. Mr. Wright believes himself fully qualified to decorate his buildings and the results have sometimes been rather meagre, or worse, confusing.

THE CHAIRMAN: I wonder if you would be kind enough to tell us whether in these days when, over here certainly, private patrons can do so little financially, you have any notable instances in the United States of big business corporations who have proved to be enlightened patrons of artists?

PROFESSOR SPONENBURGH: Yes, though of course I cannot supply you with statistical data, but there are encouraging signs. The one firm that does come to mind at this moment is the International Business Machines Corporation. It is rather a frightening name and one does hesitate sometimes to apply to such an organization for support. But this Corporation has not only commissioned throughout the country, it has also circulated its collections. The General Motors Corporation has recently commissioned a huge plant, a research laboratory of sorts, outside Detroit, and several architects and artists have been called, consulted and engaged.

MR. CHAPPELOW: Of course, we have the case of the late Sir Joseph Duveen and his son Lord Duveen, who enriched the Tate Gallery with the Turner Galleries, and the modern galleries, in that order. I think many dealers are very sincere and knowledgable men, and in a way they do encourage art if they get the

chance. After all, there are not so very many enlightened dealers, it is a small class really.

THE LECTURER: My point was to put the influence of the dealer into historical perspective. I have the greatest respect for the good dealers. They have done an immense amount for art, and for artists in particular. One has only to study the list of artists who have had their first one-man exhibitions in this country at the Leicester Galleries to realize what an incredible flair for picking the winners Mr. Brown has had over the last fifty years. One cannot say the same of government departments or of industry; but the dealer can deal only in something that is easily transportable, something that can be taken away and hung on a wall. It is as I said in my paper; it is so easy to get the whole of art divorced from life. Not that we are not interested in art, we are; everyone is intensely interested, but the processes of getting it into the life of the people have been diverted. The dealer can only encourage those types of work that are saleable. He can encourage the small piece of sculpture which can be put on people's mantelpieces. When some artist is foolish enough to spend an enormous amount of his own money on producing a large-scale work of art, then what can result? He does the work in a kind of vacuum and under great and diverting financial strain. He creates solely for what he has in his mind and two things can then happen. Either someone decides that he has got the space into which to put the work, very much unrelated to its surroundings, or it can find its way into a museum. Now if a great work of modern art finds its way into a museum, it is going to continue to be of cost to the public for ever after. It has got to be kept, buildings have got to be maintained and lit, attendants have to be paid. There is money for all these things and money to keep all the schools going, training enormous numbers of students, but there is not a penny of public money available when somebody has a great idea which he wants to incorporate as a constructive part of the civic scene. There is no body to which, for example, any architect can go and say, 'I have a project for a university building where there is a wall sixty feet long and ten feet high, protected from the weather, giving on to the public street and which the students pass daily, which is crying out for *Sgraffito* decoration. And I know of a first-rate artist who has been longing for the opportunity to create in this medium, but the clients have insufficient money'. Should there not be somebody to whom that architect can apply for at least a little financial encouragement in getting that artist that particular commission, which a great number of people will be able to see as part of their daily lives? Sir Jacob Epstein tells me he worked for twenty years without a single commission.

MR. J. N. ARCHER: I come from the Ministry of Education at Mr. Osman's kind invitation. I am afraid I cannot help him over *Sgraffito*, but I would just like to add a word about the numbers of art students. He spoke of 10,900, that is the last available figure for the number of full-time students in local authorities' art schools. On two subsequent occasions he spoke of 20,000. I am not quite sure what that figure is, but I would like to make it quite clear that there are 10,900 full-time students in art schools and that figure compares with about 6,000 before the war, and about 15,000 six years ago. There was this post-war influx of art students who finished their service in the Forces. I think that is rather an interesting picture—a very big post-war increase and then this falling away again to about 10,000. Not all of those are studying art. Something over a thousand are studying architecture and photography.

Now the other point I would just like to make; I want to be non-controversial. One often hears the criticism that there are too many full-time art students, but if any move is made to shut an art school, or to reduce its number of courses, you will find that there will be very severe criticism from that art school and many others besides. We have had experience of that recently, and you have probably read a lot

of critical comment in the press. I would like you to bear that in mind. It is rather like trying to cut down expenditure; everybody agrees that it is a good thing to do, but if you attempt to cut any particular item, everybody tells you that the wrong one is being cut. We have got almost 200 schools of art in this country, not all of them doing full-time work—which is a very big figure indeed. (Professor Sponenburgh mentioned 350.) But it is not easy to cut down.

THE CHAIRMAN: I wonder, as you come from the Ministry of Education, if you would be kind enough to say a word on another point. The new schools that have been built since the war, and particularly those built in Hertfordshire, have been very much admired by visitors from all over the world. Would you mind telling us how much authority rests with the County in such matters, or whether they are in close consultation with your architects at the headquarters of the Ministry of Education?

MR. ARCHER: This is slightly off my beat, but of course we have got an Architects and Buildings Branch at the Ministry of Education who look at all plans, but they are careful not to interfere with questions of taste and style. That is left largely to the individual architect. There are, of course, building regulations, and local authorities have certain powers and discretion to spend money on embellishing the buildings.

THE LECTURER: I was amused by Mr. Archer's coupling architecture with photography and eliminating it from the sphere of art altogether! On the point of 10 or 20,000, I obtained a figure of 10,958 for 1954 to 1955 from the Ministry of Education, but this is only for full-time students and for institutions which come under their jurisdiction, it includes the universities—and, for example, the Slade School—and all the other training establishments, and part-time students. All these occupy the services of a great number of teachers. The comparable figures are 1,260 full-time and 4,727 part-time teachers under the Ministry, and so probably about 7,000 altogether. I say that many of those teachers would be better creating works of art, and that those with a genuine gift for teaching would be far better teaching the limited number of creative and possibly-creative students instead of being provided with just that little sinecure which prevents them really trying to earn their own livings. I have met it so often. If we can afford to keep all this great number amused, and it is worthwhile if a few make the grade, fine, but there are certain great artists in the world at the moment, you can count them on your fingers and very rarely are they given commissions worthy of them by the community. They can only tackle a certain number each, which would leave scope for the younger genius and not-quite-genius for the ordinary jobs. But the market is flooded. Let there be fewer artists and more commissions, and let the commissions be imaginative and allotted by those with interest, knowledge and sympathetic understanding. These are the main points I wish to make; that somebody must understand that the artist is a man of temperament and that a little money (I do not know what it costs to keep 20,000 art students going) should be available for the great contemporary artists to leave for future generations something which is really worthy. So many now produce works which they themselves are not very proud of. They feel that something has gone wrong.

It is just not true that the artists of genius are not known during their lifetime. Apart from the odd exception, like Blake, they are—Leonardo was and Picasso is—but what has the British Government commissioned from Picasso?

MR. BATTEN: I spoke before as the Sculptors' President, now may I speak as a sculptor. Please do not cut down art schools so that there are fewer students. Out of so many students the odd genius survives. It is impossible during the early

period to decide who is the good artist. He is nearly always the overlooked man in the early days. Likewise we want as many different bodies commissioning works of art as possible, so that there are as many different opinions as possible operating. I know I am arguing against myself, as the President of the Royal Society of British Sculptors, but I think we want lots of different people, even if they can only give small commissions, so that the few artists who are vitally important somehow survive in the world during that time in which it is impossible to recognize who they are. That is, during their lifetime. So I beg you not to cut down the numbers of art students or cut down the number of bodies commissioning. Let as much go on as possible. In that way the thread will deviously pass and survive.

MR. S. C. CALDER: We are on an extremely wide subject, and it is very difficult to concentrate one's ideas into a line of thought that is constructive. The bulk of the conversation that has occurred in this discussion has been on architecture. I am particularly interested in reproducing works of art, prints and so forth, and my company find and commission or buy a large number of designs and works of art in the course of a year. We find it extremely difficult to get from art schools the type of work which interests the public. Now I quite understand that many artists will say that the public is uninformed, and perhaps what they want is not what we ought to give them, but we have to stay in business to live and so, of course, we have to give them to some degree what they require.

We find that the quality of the work of the art school, and of people who come from the art schools, is lacking in this respect: that they do not relate it to the medium by which or in which it has to be reproduced. We have had to train our own artists in our own studios to try to get them to understand what is required for that reproduction. Like our friend here, the sculptor, I feel that training under the people who are actually good at the job and are experienced at it is perhaps better than the looser, too-free expressionist training of an art school, under a teacher who has possibly got the job because he cannot find commission work and make a living at it. I do know that in some cases that is a fact.

I would not under any circumstances suggest a reduction in the number of art schools or students, because I think one gets the best eventually. They sort themselves out. I am terrified, though, of the quality of the people who are teaching art students, with notable exceptions. They do not teach them, in many cases, the A.B.C. of the job before they let them go ahead trying to do commissioned work. They have got to learn the job right from the bottom first and work jolly hard at it before they can hope to get commissions that are going to give them a good living.

MR. ARCHER: I would like to stress the point that the number of full-time art teachers is just over 1,200 and, as we have heard, the number of full-time art students is around about 10,000, but if you are going to bring in the number of part-time students and teachers, that is a different matter.

THE LECTURER: I hope that the principle of what I have been talking about is not going to be fogged by the actual question of numbers.

MR. WYNNE: Does the lecturer think that, if there were no art schools at all, and all grants were stopped, if a person were found who was potentially a great artist, he would be in any way impeded in his progress?

THE LECTURER: That is exactly what has happened so many times in the past. There is the case of Bewick, the wonderful engraver, who absented himself from his ordinary school in order to go either fishing or drawing, and who never went to an art school. But if there were no art schools what would replace them in our social set-up? One cannot revert completely; new requirements have to be met and a technique has to be learnt. I do not think, for example, one could eliminate all

schools of architecture, because architects have to learn the A.B.C. of their craft, and I certainly would not say that nothing was learnt in an art school, particularly when there is an inspired teacher. I do say, though, that the number of inspired teachers, which is very often a different thing from being an inspired artist, is very small. When there is an inspired teacher, the student can learn; students can express themselves volubly and irrepressibly, others have their inspiration sublimated and have to have it encouraged for them. There is a passage in the recent autobiography of Yehudi Menuhin. Menuhin visited Toscanini in his hotel. The telephone rang. When Toscanini could ignore it no longer, he seized the wire with both hands and tore it out of its moorings, plaster and all. Without a word he turned to the piano and went on with the rehearsal. Menuhin comments 'I had never seen anyone obey his impulses without a second thought or regret. Taught from babyhood to keep my emotions under rigid control, I early learned to sublimate into music-making everything that was in me of the dark free world of impulse. But here before my own eyes a person obeyed his impulse, and the others thought it natural'. I think that when someone has inner feelings that must come out, then training merely helps the process.

MR. GEOFFREY CLARKE: I was very fortunate, when I left the Services, in going to an art school where the teacher was one of the very few genuine teachers in this country and a very inspired person in himself. He gave a student great self-confidence. I never saw any of his work at that time; he did not force his personality at all and his work was somehow never noticed. Yet I know he could bring out the best in everyone else.

MR. CHAPPELOW: Of course, we have to allow for the fact that people develop as they grow. I knew a man once who was a very fine and artistic judge of jewellery, who had started life as a plumber. He became an expert and was able to command a very handsome fortune, despite his lack of early training as a jeweller.

MRS. LOUIS OSMAN: It has not been mentioned that the old method of training was by way of apprenticeship, which I personally think is the finest training for any art as well as trade. One gets the practical experience the hard way and everything combined in one. I feel that if there were more apprenticeships available to the young people, rather than art schools, we would get a far higher standard.

THE CHAIRMAN: You are thinking of, for instance, the 'School' of Reubens rather than a large building called the school.

MRS. OSMAN: Exactly.

MR. D. J. AVERY: I do agree with the last speaker. I think that where art schools fail, and I speak not as an art student, but as one who has a great number of friends who teach in art schools, is that they try to base themselves on the art departments of the universities. Those departments are not concerned with art. They are mainly concerned with fitting inside an academic syllabus an easy way to teach it. What they have produced is not artists but art historians, picture restorers, and so on. I think that is doing dreadful harm to art, and that the great thing is to get back to the artist's original inspiration. The artist should be in his own influential circle.

MRS. A. M. JUKES: It might be a good thing if men art students were asked at the beginning of the course if they would be able to keep themselves for five years after. I have known art students who, soon after they have left the College, have been one a barman and one a cloakroom attendant; others have to do farming, one who was very good at modelling animals is now in charge of a nature area in Africa, and one is a lion-tamer. They have had to take up other work because they could not live

through the years until they had become known. Two of them have gone into motor works, doing modelling of chassis and handles, and other things.

THE CHAIRMAN: I take it that your point is that it is foolish for them to think that an artist who is ready trained after three years can step into a well-paid job. He must be prepared to finance himself for a period.

MRS. JUKES: It seems to me so cruel to teach students while letting them think they are going to be able to live well during those first years. Of course, with regard to what Mr. Osman said about giving Commissions to the known people, the good men, we cannot know who are the good men until they have had a chance of showing what they can do.

MR. BATTEN: What is going to happen to the unfortunate genius if he is to be told that, if he has not got a private income, he cannot go to a school of art? I think that is very shocking indeed. It is most unlikely that a genius will have a private income that he can quote when he presents himself at an art school, or to live on afterwards. He has got to knock about in the Fulham Road, as we say, after the scholarship stops. A student gets his fourth-year grant and when it finishes he steps off the plank. I feel very strongly about this. At the end he has got to survive somehow, if he feels that he has something of importance to say. There is no other answer. He is just kicked around and survives somehow.

MR. AVERY: Surely the important thing about having so many art graduates each year is not that they do not become artists, but that they help to form, if they do not go into art to get their living by it, a very wide intelligent public which understands painting and perhaps in the future commissions more works of art.

A vote of thanks to the Lecturer was carried with acclamation, and the meeting then ended.

GENERAL NOTES

THE ROYAL ACADEMY WINTER EXHIBITION

Again and again, in the succession of Academy Winter Exhibitions, we have been reminded of the kindred associations of the Royal Academy and our pioneering Society. Nor is that surprising, seeing how small and intimate was the world of London art in the eighteenth century. In the Academy's present notable exhibition of over 800 portraits of British people, recorded by their favoured artists regardless of nationality, one may find all manner of interesting links between the two institutions revealed in artists or their sitters, especially in the eighteenth and nineteenth centuries. A conspicuous example is James Barry's drawing of himself reproduced overleaf, which this Society has lent to the Exhibition to recall that troubled figure, the strenuous and historically ambitious decorator of our Great Room. Barry, who had been the Royal Academy's Professor of Painting, is represented as well by his portrait of the first Duke of Northumberland, painted probably in about 1784 when the artist was at work on this Society's historic paintings in which the Duke also figures. Naturally, no less interesting to Fellows of this Society is Winterhalter's canvas of the Prince Consort represented, with the Queen, in period costume at a fancy dress ball at Buckingham Palace in 1851, one of many pictures graciously lent by Her Majesty The Queen.

It is clear that its great documentary interest is the *raison d'etre* of this assemblage, which extends from Tudor times to the present day, and has been chosen, hung, and catalogued with such exemplary care by Professor E. K. Waterhouse and his

James Barry, self portrait

associates. A collection that might so easily have appeared uniform and somewhat monotonous has been diversified by a remarkable selection of sculptured busts, miniatures, and drawings, as well as by those conversation and theatrical pieces in which this country has been peculiarly rich. In an exhibition fascinating for such various reasons, one is most intrigued by the 'period face'. Have there been subtlest changes in our features over the centuries, or are we deceived by the changing artistic conventions? Certainly the classical Langtry features, so noticeable in late Victorian photographs, already appear 'dated'. May we not then infer that a prevalent Elizabethan countenance was perhaps almost as wan and withdrawn as it is portrayed?

If so, that might lead us to conjecture that bad drainage in one period, and good living in another, duly affected these ancestral faces, even if a Hans Eworth might have been prone to exaggerate the pallor, or a Raeburn the floridness, of studio sitters. But that the actual *cast* of features—such as the regular, classical ones just mentioned—should have seemed to go out of fashion, remains a mystery unexplained.

How strange it is, one reflects again, that an age so rumbustious as the Elizabethan should have expressed itself in the ethereal delicacy of its sonnet and enchanted portrait. Poetry and painting merge, indeed, in the harmony of dove greys and pinks of that lyrical portrait, supposedly of Mary Fitton, the dark lady of Shakespeare's sonnets. From the art of the Elizabethans one moves to the next century's most discerning miniaturist, Samuel Cooper, the 'Van Dyck in little', set in a room whose troubled canvases reflect the dark tragedy of the Civil War. Here are Daniel Mytens' *Charles I*, truer, less virtuous image than Van Dyck's, and *The Cotterell Family* painted during their exile in the Interregnum by Jan Mytens. Turning aside, one finds, in the Lecture Room, all the luxury of the period sublimated in Lely's idyllic rendering of the youthful *Henry Sidney, Earl of Romney*, and its voluptuousness in his reclining *Nell Gwyn* undraped.

The later centuries are likewise illuminated, for the most part, by unhackneyed pictures and portrait busts. Hogarth's *Garrick as Richard III* is an immediately striking, rhetorical composition, only somewhat lacking in unity. The same actor is portrayed in a marble bust by Nollekens, and as 'Don John' in a water-colour by Philip de Loutherbourg. Reynolds is seen most nobly in three portraits of himself from youth to the verge of blindness; Gainsborough most buoyently in that familiar and ravishing full-length of *Mary, Countess Howe*, from Kenwood, and in his less familiar and sketchy portrait of Lord Abingdon; while Zoffany and other painters of the period appear equally at ease.

Wilkie comes well out of the exhibition, prefacing the Victorian age which provides perhaps the most fascinating part of the collection. Paintings like Landseer's *Queen Victoria at Osborne* or Frith's *Private View of the Royal Academy*, 1881, are clearly of more interest as documents than as paintings; but these Victorian rooms are not lacking also in paintings as wholly admirable as Francis Grant's monumental study of the Duke of Portland 'in his leathers', the most sensitive and moving *Mrs. Mitchell and Child*, by Alfred Stevens, or Alma-Tadema's astonishingly precocious self-portrait at the age of 16, which gives no hint of the Grecian marble to come.

Mr. John Woodward has been as tactful in his hanging of this century's portraiture, where painters as irreconcilable as Sickert and Sargent, Orpen and Gwen John, rub shoulders here without offence. A short 'epilogue' to the exhibition—arranged, it appears, rather as an after-thought—introduces a few contemporary portrait-painters, among them Signor Annigoni with his well-known presentment of Her Majesty The Queen, and Mr. Graham Sutherland, who enters the Academy for the first time with a previously unexhibited and intense portrait of Mr. Edward Sackville-West. This little token group brings to a close, more discreetly than might have been thought possible, one of the most stimulating exhibitions we have seen for years.

NEVILE WALLIS

JAMES BARRY'S ANNUITY: ACQUISITION OF PAPERS

A collection of manuscripts containing 65 items relating to a proposed annuity for James Barry has been purchased by the Society from Mr. D. A. Edlin.

The annuity represented an attempt by members of the Society to make financial provision for an artist whose work they admired and cherished but whose extreme temperament had made him choose a life of poverty. Barry had received financial recompense from the Society for his work in its Great Room, as the Lecture Hall was then called, in 1781 when he was awarded £50[1] and in 1784 when he received a gold medal and £250[2]. A further honour was paid to him in 1804. The annual

volume of the Society's *Transactions* had as its frontispiece an engraving of his self-portrait[3]. It was this tribute which prompted a letter from the Earl of Buchan[4] which is perhaps the most interesting item in Mr. Edlin's collection:

Edinburgh, December 28th, 1804.

Sir,

I have learnt with great satisfaction, that the respectable Society for the Encouragement of Arts of which I have the honour to be one of the most ancient members has employed that eminent engraver Mr. Heath, to engrave the portrait of Mr. Barry from the original picture which that great Genius and excellent Man had long ago painted and copied into the picture of the Olympic victory in the Hall of the Society in the Adelphi. I request of you at the first meeting of the honble. Society to assure them of my high approbation of this act of Justice to a Gentleman whose merits are acknowledged universally except in his own country where he has been strangely neglected except by your much and justly esteemed Institution[,] to be connected with which from my early Youth I consider as one of the handsomest feathers in my literary cap.

I am glad to hear that this print of Mr. Barry's portrait is meant to be prefixed to the next volume of your Transactions and hope that in the Preface a just tribute of praise will be assigned to the *Leonardo da Vinci* of our Country and Nation whose name in spite of envy and detraction will be handed down with honour to a late posterity.

But Sir this is not enough,—I desire to renew my request to the individual Members of the Society as well as to the Society at large that a donation of Yearly annuity may be settled on the worthy Barry as Emeritus of the Society and of the fine Art of painting in Britain. I know very well that the Society cannot grant such annuity *as a Society* but it can with propriety recommend to its members as individuals to unite in covering such grant and in this I will with high pleasure cooperate.

Be pleased Sir to communicate these sentiments and this proposal to the Society at its first meeting and to inform me of the result of its deliberation thereupon.

I am Sir,
With high respect for the
honourable Society and with
regard to yourself,
Yr. Ob. hbl. Servt.,
BUCHAN.

To the Secretary
of the Society for the Encouragement
of Arts, etc., Adelphi London.

Lord Buchan's letter was referred by the Society to its Committee for Correspondence and Papers on 9th January, 1805. The Committee recommended that no action should be taken and they were then asked to reconsider the matter. On 28th January they suggested that although it was 'foreign to the views of the Society to grant any Annuity', the Secretary should 'be permitted to receive voluntary subscriptions from individuals in order to provide an annuity for the life of Mr. Barry'.[5]

The Secretary, Dr. Charles Taylor, wrote to Lord Buchan on 7th February, communicating the Society's decision and informing him 'that a very considerable number of the individuals who compose it now only wait for an example from your Lordship's subscription'. His concluding paragraph shows his personal interest in the case[6]:

Your Lordship will I trust excuse my Earnestness on this Occasion as it arises from a Desire to give Success to your good Intentions; be assured my

Lord that in the present Moment when many Gentlemen are now warmly disposed to purchase an Annuity for Mr. Barry any Delay or punctilio will be dangerous to the grand Object in View; Your Lordship may therefore depend that immediately on receiving your Lordship's Subscription no Endeavours shall be wanting on my part to carry your Lordship's Wishes into full Effect.

I remain with great Respect
My Lord
Your Obedt. Servt.,
CHARLES TAYLOR.

Lord Buchan's actions were as generous as his sentiments. He offered an annual subscription of £10 and his action inspired a group of his fellow Members to establish a Committee to raise further sums. The first meeting of 'Mr. Barry's Committee' was held on 19th February, 1805. Circulars were issued and it would appear that the Committee also conducted some investigations into Barry's financial circumstances. Among the Edlin papers are receipts for payment by Barry of taxes and water rent. Barry himself seems to have been informed of the proceedings and to have communicated with the Committee. There is a draft of a letter to him from Charles Taylor mentioning his desire to know of the proceedings of the Committee.[7]

Letters in response to the appeal came from Edmund Baker and William Hawes[8], and these have been preserved among the papers acquired. Baker presented £25 on behalf of the Literary Fund and four guineas as his 'humble mite *anonymously* towards the same esteemed purpose. The few opportunities [he continued] that occur of showing respect for merit so very transcendant in the Arts, makes [me] anxious to avail myself for the gratification of this *Motion* without the ostentation of the *action*'[9]. Hawes, writing in the third person, assured Charles Taylor that he had 'no objection to his *mite* being known to a private friend, *but no further*'. 'God grant', he wrote, 'that in the present instance Mr. Barry may have *his woes made lighter* and his age rendered comfortable'. He wished the entry relating to his subscription to take the following form:

Delightful task to soften human woe
Tis what the happy to the unhappy owe } 2.2.0[10]

A printed list of subscribers records a total of nearly £1,000[11]. The largest contribution made by a private individual was £100 from a gentleman of Cork, Barry's birth-place. Another inhabitant of Cork gave £50, as did Sir Francis Baring[12] and the Earl of Radnor. Benjamin West, the President, and two other Members showed by their subscriptions that the Royal Academy was prepared to forget the troubles of its past relationship with Barry. The Society of Arts in its corporate capacity contributed £100[13]. An annuity yielding £120 was purchased from Sir Robert Peel Snr., but before the first payment could be made Barry was dead[14].

The Edlin papers add to our knowledge of an interesting incident in the association of James Barry with the Society. They are a useful addition to the Society's archives[15].

D. G. C. A.

[1]. *Transactions of the Society of Arts* III p. 107. Barry also received an advance of money from the Society to enable him to hold public exhibitions of his paintings for the Great Room.

[2]. *Ibid.*, XVII p. 365. In 1801 the Society allowed Barry to publish an account of some additions he had made to the Great Room paintings in which he referred to 'the dark designs of interested individuals against his honour, his interest, and his peace; and especially as they have been so managed as to influence the mind of his Sovereign'.

Ibid., XIX p. xxvii *et seq.*

[3]. *Ibid.*, XXII.

[4]. David Steuart Erskine, 11th Earl of Buchan, antiquarian and art patron. See *Dictionary of National Biography*, XVII p. 403.

[5]. [Royal] Society of Arts, Minutes of Committee of Correspondence and Papers, 14th and 28th January, 1805.

[6]. *Edlin Papers*, Copy of letter by Charles Taylor in his own handwriting to the Earl of Buchan, Society of Arts, etc., Adelphi, London. 7th February, 1805.

[7]. *Ibid.*, copy of letter by Charles Taylor in his own handwriting to James Barry, Adelphi. 19th February, 1805.

[8]. William Hawes, the founder of the Royal Humane Society. See *D.N.B.*, XXV p. 190. He was elected a member of the Society of Arts in 1802.

[9]. *Edlin Papers*. Letter by Edmund Baker to Charles Taylor, 42 Broad Street, Golden Square. 20th April, 1805.

[10]. *Ibid.*, Letter from William Hawes to Charles Taylor, Spital Sq. 30th May, 1805.

[11]. *Ibid.*, printed notice entitled 'Mr. Barry's Annuity, List of Subscribers'.

[12]. Sir Francis Baring, Bart., the financier. See *D.N.B.* III p. 192. He was elected a member of the Society in 1762.

[13]. [Royal] Society of Arts, Minutes. 27th February, 1805.

[14]. On 13th November, 1805, the Society asked Barry to paint Nelson's portrait into the panel entitled 'The Triumph of Modern Commerce'. On 5th March, 1806, it resolved that his body should rest in the Great Room preceding its interment. [Royal] Society of Arts, Minutes. 13th November, 1805; 5th March, 1806. See *D.N.B.* III p. 324, and Professor Thomas Bodkin, 'James Barry', *Journal of the Royal Society of Arts*, LXXXIX (1940–41) pp. 34–53, which has a useful bibliography.

[15]. Mr. Dennett Annesley Edlin inherited these papers from his father, Vernon Annesley Edlin, who is believed to have purchased them.

ARTISTS OF TO-DAY EXHIBITION

An exhibition of paintings in aid of the Multiple Sclerosis Society is at present on view at the Prospect Gallery, 13 Duke Street, St. James's, S.W.1, where it will remain until 22nd December. The proceeds from the sale of the paintings, which have been given by their artists, and of catalogues, will go towards the cost of research into the cause and cure of Multiple Sclerosis, and to help its victims. The exhibition is open daily on Mondays to Wednesdays from 11 a.m. to 5 p.m., on Thursdays from 11 a.m. to 7.30 p.m., and on Saturdays from 10 a.m. to 1 p.m.

ROYAL PORTRAITS AT THE IMPERIAL INSTITUTE

An exhibition of paintings by the Canadian artist Llewellyn Petley-Jones is at present on view at the Imperial Institute, where it will remain until 30th December. The exhibition includes the two recently completed portraits of H.M. The Queen and of H.R.H. The Duke of Edinburgh, which have been commissioned by the Government of Alberta to hang in the Legislative Chamber of the Parliament Buildings in Edmonton. The exhibition is open on Weekdays from 10 a.m. to 4.30 p.m.; on Saturdays from 10 a.m. to 5 p.m.; and on Sundays from 2.30 p.m. to 6 p.m. Admission is free.

WORK FOR THE DISABLED

It is now ten years since the opening of the first factory by Remploy, Ltd. marked the beginning of their scheme for the productive employment of physically disabled persons. Since then, ninety factories have been set up in various parts of the country, wherever the Register of Disabled Persons has shown most need, while work is provided in their own homes for those unable to travel. At present, over 6,000 disabled men and women are employed by the company making, among a wide range of products, furniture, industrial equipment, knitwear, metal windows,

and sectional buildings. Some 2,000 workers trained in Remploy factories have been able to take up work in open industry.

An interesting development in the past year has been the start of a Sponsorship Scheme, by which Remploy provides a factory, services, labour and skilled management to firms wishing to expand, who, in return, undertake to re-equip the factory if necessary, and to provide technical advice and raw materials, finally buying the finished product at an agreed price.

OBITUARY

LORD DULVERTON

We record with regret the death, in Gloucestershire on 1st December, of Lord Dulverton, at the age of 76.

The Right Honble. Sir Gilbert Alan Hamilton Wills, O.B.E., M.A., J.P., first Baron Dulverton, of Batsford in the county of Gloucestershire, was educated privately, and at Magdalen College, Oxford. He then spent a year in the Wills tobacco factories, and joined the Royal North Devon Yeomanry. At that time he formed the Dulverton Foxhounds, of which he was joint master. In 1908 he became an A.D.C. to the Lord Lieutenant of Ireland, in which country he spent four years. In 1909 he succeeded his father as second baronet.

In 1912 he was returned, as Sir Gilbert Wills, to Parliament. During his service in the First World War he was twice mentioned in dispatches, and in 1919 was appointed O.B.E. After a period as Parliamentary Private Secretary to the Postmaster-General he decided, in 1923, not to stand for re-election, in order to devote himself to business of the Imperial Tobacco Company. In the following year he succeeded his cousin as chairman, and was largely concerned with the formation, in 1931, of the Tobacco Trade Association.

He was a J.P. for Somerset and Gloucestershire, and in 1928 was High Sheriff of the latter county. He was created a baron in 1929. Lord Dulverton had also been a director of the British-American Tobacco Company, and of the Great Western Railway. In 1947 he resigned his chairmanship of the Imperial Tobacco Company of Great Britain and Ireland, of which he was then elected President, which he remained until his death.

The city of Bristol benefited considerably from his benefactions, the restoration of St. Mary Redcliffe and of the great hall of Bristol University being among the results of his generosity. In 1953 he presented Bristol Art Gallery with a fine collection of Chinese porcelain.

Lord Dulverton was elected a Life Fellow of the Society in 1930.

DR. J. H. PARTRIDGE

We also record with regret the death, on 30th November, of Dr. J. H. Partridge.

John Henry Partridge, B.Sc., Ph.D., as a member of the Research Staff of the General Electric Co., Ltd., delivered a Course of three Cantor Lectures on 'Refractory Metals' to the Society in 1938. He was elected a Life Fellow in 1947.

FROM THE JOURNAL OF 1856

VOLUME V. *5th December*, 1856

SNAKE BITES

From a letter on Experiments with Snake Root.

A thick leather boot will not always protect a person from the bite of a snake. A very singular example of this was related to me. A man wearing a pair of stout boots, which came up to the knees, shouldered his axe one fine morning, and proceeded to the forest to cut wood. After he had aimed a few strokes, a snake, not approving of his proceedings, bit him in the calf of the leg. Our woodman, however,

thinking that his boot had sufficiently protected him, laughed at the snake, and went on with his work. But after a little time a feeling of sickness and stupor came over him, and he thought it advisable to wend his way home, which he did, and died in about an hour after he had got there. The boots—they were capital boots—were sold. The fortunate possessor, as he thought himself, carried them home, and then put them on to see if they would fit. In a few hours he was a corpse. This was considered very strange—some thought it was apoplexy, some paralysis, and some thought it was an affection of the heart—but nobody thought of suspecting the boots. In a short time they again had an owner. It will scarcely be credited—but it is a fact—this man died also. At length the boots were examined—what caused the investigation I do not know, but I suppose the fell Atropos thought she had done enough mischief with a pair of boots—and in one of them was found sticking the tooth of a snake, in such manner that in drawing on the boot the leg must inevitably be scratched by it.

STANDING COMMITTEES, 1956-57

The following should be added to the list of Society's Standing Committees for 1956–57 published on pp. 21–25 of the last issue of the *Journal*:

EXAMINATIONS COMMITTEE

Appointed by Central Education Authorities:

England (Ministry of Education): E. I. Baker, H.M.I., in place of C. E. Beevers, C.B.E., M.Com., H.M.I.

Appointed by Local Education Authorities:

L.C.C.: W. F. Houghton, M.A., in place of J. Brown, C.B.E., M.C., LL.D.; Liverpool: T. Gore, M.A., B.Sc.(Econ.), in place of A. R. Burnett-Hurst, M.Sc.

Appointed by Teachers' Associations:

Association of Teachers in Technical Institutions: F. B. Garfoot, A.C.I.S., in place of J. H. Harvey, B.Com.

National Federation of Continuative Teachers' Associations: J. F. Nicholls, in place of W. T. Scales, A.M.I.I.A.

R.D.I. JOINT COMMITTEE

Appointed by the Faculty of R.D.I. for 1956:

Professor R. D. Russell, F.S.I.A.

LIBRARY COMMITTEE

Substitute Lord Nathan for Lord Latham.

MEMBERSHIP COMMITTEE

Sir Griffith Williams.

Some Activities of Other Societies and Organizations

MEETINGS

SAT. 8 DEC. Horniman Museum, London Road, S.E.23. 3.30 p.m. J. Usborne: *Watching North American Birds.*

MON. 10 DEC. Analytical Chemistry, Society for, at the University, Glasgow, W.2. 7.15 p.m. Edgar Rentoul: *Problems and Techniques in Forensic Analysis.*

Electrical Engineers, Institution of, Savoy Place, W.C.2. 5.30 p.m. Discussion: *Unsolved Problems Arising from Automation.*

Imperial Institute, S.W.7. 5.45 p.m. C. Price Conigrave: *Man on the Spot—Australia.*

Road Transport Engineers, Institute of, at 90 Deansgate, Manchester. 7.30 p.m. T. P. O'Donnell: *The Application of Electric Power to Passenger and Goods Road Transport.*

Transport, Institute of, at 66 Portland Place, W.1. 5.45 p.m. Sir Charles Goodeve: *Man Must Measure.*

TUES. 11 DEC. Architects, Royal Institute of British, 66 Portland Place, W.1. 6 p.m. Professor H. Myles Wright: *The Motor Vehicle and Civic Design.*

Chemical Engineering Group, 14 Belgrave Square, S.W.1. 5.30 p.m. M. K. Schwitzer and D. Malcolm: *The Manufacture of Nitrogen Derivatives of Fatty Acids.*

Industrial Transport Association, at the Royal Society of Arts, W.C.2. 6.30 p.m. C. Courtney Cramp: *The Economic Relationships of Transport.*

International Affairs, Royal Institute of, 10 St. James's Square, S.W.1. 1.30 p.m. Professor J. E. Meade: *Britain and the European Common Market.*

Manchester Geographical Society, 16 St. Mary's Parsonage, Manchester, 3. 6.30 p.m. C. Fisher: *The Political Geography of Malaya.*

Mechanical Engineers, Institution of, 1 Birdcage Walk, S.W.1. 6 p.m. A. E. Moulton and P. W. Turner: *Rubber Springs for Vehicle Suspension.*

Metallurgical Society, North East, at the Technical Institution, Middlesbrough. 7.15 p.m. Dr. A. H. Cottrell : *Dislocations and the Strength of Metals.*

Metals, Institute of, at the University College, Singleton Park, Swansea. 6.45 p.m. J. C. Bailey : *Recent Developments in Aluminium Alloys and their Uses.*

Road Transport Engineers, Institute of, at the Engineering Centre, Stephenson Place, Birmingham. 7.30 p.m. T. J. Phipps : *The Development and Operation of Disc Brakes.*

WED. 12 DEC. Archaeological Institute, Royal, at Burlington House, W.1. 5 p.m. J. R. C. Hamilton : *The Shetland Islands in the Iron Age.*

Chemical Engineers, Institution of, at the Midlands Institute, Paradise Street, Birmingham. 6.30 p.m. Professor F. H. Garner, C. W. Nutt and C. A. Le Merle : *Heat Transfer and Pressure Drop in Packed Beds.*

Electrical Engineers, Institution of, Savoy Place, W.C.2. 5.30 p.m. E. W. Hayes and H. Page : *The B.B.C. Sound Broadcasting Service on Very-High Frequencies.*

Engineering Inspection, Institution of, at the Royal Society of Arts, W.C.2. 6.45 p.m. Dr. L. Mullins : *Engineering Inspection by X-rays and Gamma-rays.*

Eugenics Society, at the Royal Society, Burlington House, W.1. 5.30 p.m. J. W. B. Douglas : *Effects of Maternal Employment on the Health and Development of Young Children.*

I.C.I. Merseyside Scientific Society, at the Castner-Kellner Works, Runcorn. 5.15 p.m. G. V. Davy : *Railway Electrification.*

Newcomen Society, at the Institution of Civil Engineers, Great George Street, S.W.1. 5.30 p.m. H. R. Johnson and Professor A. W. Skempton : William Strutt's Fire-proof and Iron-framed Buildings, 1793-1812.

Photographic Society, Royal, 16 Princes Gate, S.W.7. 7 p.m. D. Kemp : *Difficulties and Dangers of Caving with a Camera.*

Physical Society, at the Imperial College, S.W.7. 3.30 p.m. Professor W. D. Wright, Miss Tilleard, and P. S. Williams : *Colorimetry : its errors and accuracy.*

Radio Engineers, British Institution of, (1) at the London School of Hygiene, Gower Street, W.C.1. 6.30 p.m. Dr. T. B. Tomlinson : *Principles of the Light Amplifier and Allied Devices* ; (2) at the Technical College, Wulfruna Street, Wolverhampton. 7.15 p.m. H. A. Fairhurst : *Design of an Experimental Colour Television* ; (3) at Neville Hall, Westgate Road, Newcastle-upon-Tyne. 6 p.m. R. A. Spears : *The Design and Application of Quartz Crystals.*

Textile Institute, at Burlington House, W.1. 7 p.m. Miss J. March : *Colour Fastness.*

Victoria & Albert Museum, S.W.7. 6.15 p.m. G. Wingfield Digby : *The Bayeux Tapestry II : the embroidery.*

THURS. 13 DEC. Chemical Engineering, at 14 Belgrave Square, S.W.1. 2.15 p.m. Symposium : *The Replenishment of Underground Water Supply : Geological and Microbiological Considerations.*

Chemical Society, at the Royal Institution, Albemarle Street, W.1. 7.30 p.m. Professor G. Gee : *Physical Properties of High Polymers in Relation to their Chemical Structures.*

Electrical Engineers, Institution of, Savoy Place, W.C.2. 5.30 p.m. Discussion : *The 13th Edition of Wiring Regulations.*

Kinematograph Society, British, at the Royal Society of Arts, W.C.2. 7.15 p.m. Dr. H. R. L. Lamont : *A Magnetic Tape Recording System for Colour Television Signals.*

Metallurgical Society, at 9 The Temple, Dale Street, Liverpool. 7 p.m. D. F. Bailey : *Shell Moulding.*

Public Health Engineers, Institution of, at Caxton Hall, S.W.1. 6 p.m. F. G. Frizzell : *The Architect's View of Public Health Engineering Services.*

Radio Engineers, British Institution of, (1) at 1 Old Hall Street, Liverpool, 3. 7 p.m. K. M. McKee : *An Automatic System for Electronic Component Assembly* ; (2) at 39 Elmbank Crescent, Glasgow. 7 p.m. J. H. Cozens : *The Design and Manufacture of Modern Capacitors.*

Road Transport Engineers, Institute of, at the Adelphi Hotel, Lime Street, Liverpool. 7.30 p.m. C. B. Bailey-Watson : *The Place of Aircraft in the Transport Field.*

FRI. 14 DEC. Engineers and Shipbuilders, North-East Coast, Institution of, at the Mining Institute, Newcastle-upon-Tyne. 6.15 p.m. K. Haug and N. Carter : *m. v. Bergensfjord.*

Junior Institution of Engineers, 14 Rochester Row, S.W.1. 7.30 p.m. B. Donkin : *Fuel Economy and Combined Heat-Electric Generation.*

Mechanical Engineers, Institution of, 1 Birdcage Walk, S.W.1. 6 p.m. Captain G. T. Smith-Clarke : *Mechanical Breathing Machines.*

Radio Engineers, British Institution of, at the North Gloucestershire Technical College, Cheltenham. 7 p.m. R. L. Adgie : *Radio Astronomy.*

Road Transport Engineers, Institute of, at the South Wales Institute of Engineers, Park Place, Cardiff. 7 p.m. J. Skinner : *Current Trends in Fuel Injection Equipment for Road Transport.*

Sound Recording Association, British, at the Central Library, Portsmouth. 7.30 p.m. Discussion : *New B.B.C. Disc Reproducing Equipment.*

SAT. 16 DEC. Analytical Chemistry, Society for, at the Technical College, Newport. 2.30 p.m. R. C. Chirnside : *The Co-ordination of Analytical Techniques in Industrial Research.*

MON. 17 DEC. Geographical Society, Royal, Kensington Gore, S.W.7. 8.30 p.m. Albert Eggler : *Swiss Ascent of Everest and Lhotse.*

Physical Society, The University, Edinburgh, 8. Autumn Meeting : *B- and Y-ray Spectroscopy and Related Topics.*

TUES. 18 DEC. Electrical Engineers, Institution of, Savoy Place, W.C.2. 5.30 p.m. Discussion : *Breakdown in Dielectrics.*

Physical Society, The University, Edinburgh, 8. Autumn Meeting : *B- and Y-ray Spectroscopy and Related Topics.*

WED. 19 DEC. Kinematograph Society, British, at the Royal Society of Arts, W.C.2. 7.30 p.m. Dr. G. I. P. Levenson : *The Economics of Film Washing.*

Locomotive Engineers, Institution of, at 1 Birdcage Walk, S.W.1. 5.30 p.m. F. J. Pepper : *Carriage Warming.*

Microscopical Society, Royal, Tavistock Square W.C.1. 5.30 p.m. Dr. N. H. Hartshorne : *Some, Applications of Polarisation Microscopy.*

Numismatic Society, Royal, at Burlington House, W.1. 5.30 p.m. Dr. R. B. Whitehead : *Some Observations on the Greeks in India.*

Physical Society, The University, Edinburgh, 8. Autumn Meeting : *B-* and *Y-ray Spectroscopy and Related Topics.*

Victoria & Albert Museum, S.W.7. 6.15 p.m. P. Ward-Jackson : *English Furniture Designs of the Eighteenth Century.*

THURS. 20 DEC. Road Transport Engineers, Institute of, (1) at the Royal Society of Arts, W.C.2. 6.30 p.m. M. D. Curwen : *The Use of Plastics in Road Transport* ; (2) at the Great Northern Hotel, Wellington Street, Leeds, 1. 7.30 p.m. A. G. Slee and W. K. Cox : *Exhaust Brake Design and Operation.*

FRI. 21 DEC. Sound Recording Association, British, at the Royal Society of Arts. 7.15 p.m. J. Cunningham-Sands : *Applications of Magnetic Recordings.*

OTHER ACTIVITIES

NOW UNTIL 19 JAN. Arts Council Gallery, St. James's Square, S.W.1. (Gallery closed 22-26 December inclusive), Robert Bevan : *Paintings, Drawings and Lithographs* ; and Henri Gaudier-Brzeska : *Sculpture, Pastels and Drawings.*

NOW UNTIL 24 FEB. Science Museum, S.W.7. *300 Years of Pendulum Clocks—Special Exhibition.*